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NATIONAL FIRE PROTECTION ASSOCIATION

Quarterly

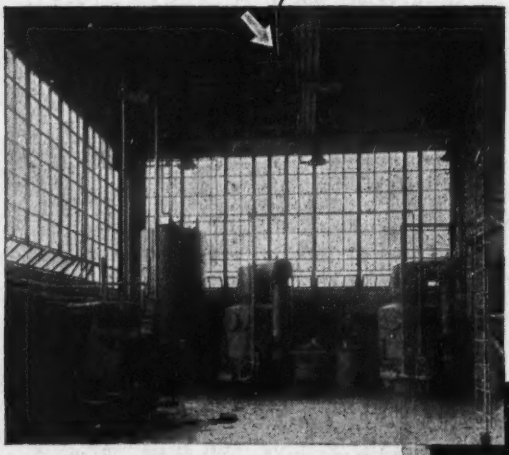
Published Quarterly at Boston, Mass., by the
NATIONAL FIRE PROTECTION ASSOCIATION
International

CARDOX

Harnesses Carbon Dioxide

IN POUNDS OR TONS

For protection of Industry's tough fire hazards



Part of Cardox protected oil reclamation plant.

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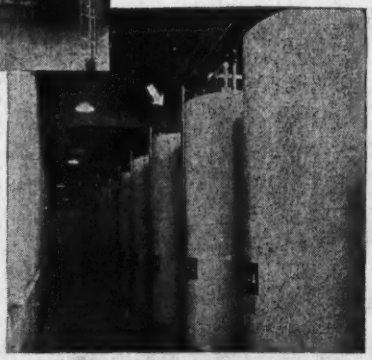

The features that have made Cardox Fire Extinguishing Systems first choice for protecting so wide a variety of tough fire hazards are many. For example, they harness carbon dioxide, in *pounds* or *tons*, and, through engineered control and application make it equally effective for large or small hazards . . . single or multiple . . . similar or diverse!

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QUARTERLY

of the

NATIONAL FIRE PROTECTION ASSOCIATION

Vol. 39 January, 1946 No. 3

CONTENTS

Oil Tank Fire, Bayonne, N. J. ..... Frontispiece
Fire Protection Developments in 1945.
Percy Bugbee 149
Large Loss Fires of 1945 153
Aircraft Hangars 159
Warehouses 163
Chemical Plants 175
Metalworkers 177
Mercantile Group Fires 188
Multiple Occupancies 189
Rubber Manufacturing 202
Food Processing Plants 204
Refineries 209
Specialized Industries (Misc.) 211
Steamships 215
Mills and Elevators 217
Special Incidents 223
Piers and Shipyards 223
Conflagrations 228
Recreation Buildings 229
Sawmills, Lumberyards, etc. 231
Truck Terminals 235
Miscellaneous Public Buildings 237
Pulp and Paper Mills 238
Textile Manufacturing 239
Forest Fires 241
The 1945 Fire Loss 241
Hartford Christmas Tree Tragedy 242
Navy Firemen's Training 244
The Fire Attacks on German Cities.
Horatio Bond 246

Accounts of fires appearing in the Quarterly are copies of or extracts from reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

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International.

The value of dykes around oil tanks and spacing between tanks at least equal to the tank diameter, as specified in the N.F.P.A. Flammable Liquids Ordinance, was demonstrated in this fire at the refinery of the Standard Oil Co. of New Jersey, Bayonne, Nov. 6, 1945. The tank contained 31,000 barrels of crude oil. Failure of a cast iron valve released oil in a spray, creating a large vapor cloud. The initial flash enveloped a sedan and a truck on a highwy 209 ft. away; the occupants suffered burns, but escaped with their lives. Fire did not spread to adjoining tanks.

The Quarterly

Vol. 39 January, 1946 No. 3

Fire Protection Developments in 1945.

By Percy Bugbee, General Manager,
National Fire Protection Association.

During the early months of 1945, fire in a form probably more devastating than ever before witnessed in world history was visited on the cities of Germany and Japan. The terrific toll of death and destruction caused by the saturation incendiary raids on the metropolitan centers of our enemies has not been fully appreciated by the general public. Some measure of what happened in Germany can be realized from the report released in the late fall by the U. S. Strategic Bombing Survey. Shortly the report on Japan will be similarly available. The fire storms reported in various German cities exceeded in intensity and devastating effect any peacetime conflagration condition and fire fighting efforts were completely futile. In due course the lessons learned from these fire raids will be analyzed and reported. N.F.P.A. Chief Engineer Horatio Bond was in charge of fire damage analysis for the Physical Damage Division of the United States Strategic Bombing Survey of Germany.

Rising Fire Losses.

Here in the United States the trend of rising fire losses continued during 1945 and the preliminary estimate of loss for the year is $450,000,000. This compares with a preliminary estimate of a year ago of $423,000,000 and is the highest loss recorded since 1930. In our summary of a year ago the continued trend to higher fire losses during 1945 was predicted and has been borne out. The many factors in wartime that make for an increased fire loss, of course, were all present during the war months of this year. The policy during the recent war of concentrating huge values in too large buildings, inadequately protected, made for disastrous fires. The number of fires in 1945 exceeding a loss of $250,000 was approximately 165. This compares with 122 such fires in 1944, 105 in 1943, 80 in 1942 and 48 in 1941. To my mind another important factor in the heavy fire losses of the year and one that has not been particularly stressed was the serious letdown in routine inspection work carried on by municipal fire departments due to shortages of manpower that most fire departments suffered throughout the war period.

Among the many spectacular fires of 1945, those that probably claimed the most public attention were the New York Harbor fire of February 5, the Dayton airplane

hangar fire of March 6, the Port Edward, Ontario, ship fire of July 17, the Empire State building airplane crash and fire of July 28, the Portland, Oregon, shipyard fire of August 30, and the Navy air base fire in Florida during the hurricane of September 15.

On January 31 fire in a baby home in Auburn Maine, cost the lives of 16 children and one nurse, and on Christmas Eve in Hartford, Conn., a Christmas tree fire in a hospital for old people cost 19 lives.

Wartime Problems.

During the first eight months of 1945 the wartime problems of fire protection and control continued. Municipal fire departments were struggling with shortages of manpower and inadequate equipment, and large amounts of essential war supplies continued to disappear in smoke at all too frequent intervals. With the coming of the peace, these fire protection problems seemed to vanish in thin air, but a whole new set of problems confronted the fire protection field. The problems of reconversion of plants from war to peace involve inevitable possibilities for serious fires unless greatest of care is taken to maintain fire protection equipment during the conversion period. It was feared that serious fires would occur in plants under conversion, but that fear has not been realized to as great a degree as was expected. Striking workers in many industrial plants endangered to a considerable extent the fire protection of the property. Responsible union leaders recognize the seriousness of permitting fire protection of a property to lapse during a strike period. Public opinion would be strongly opposed to any union action that would permit the destruction of a plant by fire. During the war and under war tension, the prevalence of smoking in industrial plants has alarmed a number of fire protection authorities. Most places have met this problem with common sense and have established areas throughout the property where it is reasonably safe to permit smoking, but have maintained a rigid prohibition of smoking in unsafe areas.

With the ending of the war, the problem of the fire protection of the tremendous quantity of surplus property became more acute and during the closing months of 1945 some steps were taken by the Reconstruction Finance Corporation to give attention to measures of fire protection. It remains to be seen whether these measures will be adequate to prevent serious losses of valuable materials.

Housing Problems.

The ending of the war turned many people's minds to the tremendous problem ahead of housing. The opportunities for providing at least the elementary safeguards against fire in the postwar housing program are too important to be ignored, and the National Fire Protection Association has been pointing out to building officials, fire departments and others in a position to influence postwar housing that we have at hand a golden opportunity to build these new homes so that the occupants will be safe against danger from fire. Many cities have revived their interest in building codes and a lot of activity now exists in the revision of city building codes. With the very acute and pressing need for new housing, however, the danger of a breakdown in existing regulations to permit definitely hazardous buildings to be erected is very real. People are demanding shelter and even the elementary rules of fire-safe construction will be broken down unless careful and intelligent guidance is given in each community.

Municipal Fire Protection.

Our municipal fire departments are facing many problems, as nearly all such de-

partments were left in a weakened condition and must rebuild to reach a desirable efficiency. Too little attention has been given to the procedures for returning veterans in the fire departments. Unless the fire departments make it attractive for these men to return and pick up their old activity, the cities will lose out. The lessons learned during the war in the field of fire fighting and firemen's training will to some extent revolutionize fire training in the next several years. All fire departments are now interested in the application of new methods of fire fighting to peacetime work, the technique of fighting airplane crash fires, the use of water fog, etc. No satisfactory procedure for the disposal of the fire apparatus developed for wartime use by the Army and the Navy and by the Office of Civilian Defense has been provided at this writing. It is to be hoped that the best possible use will be made of this large amount of fire equipment and that it won't be left to rust away without doing anyone any good.

It is satisfying to report that in the field of fire prevention education, activity seems to continue to increase. Fire Prevention Week in 1945 was probably more widely observed throughout the country than ever before in history. Winners in the Fire Prevention Week contest conducted by the National Fire Protection Association were as follows: U. S.: Memphis, Tenn., Jersey City, N. J., Chicago, Ill., Louisville, Ky., Milwaukee, Wis.; Canada: St. Jean, Quebec, Ottawa, Ont., Montreal, Quebec, Arvida, Quebec, Brantford, Ont.

In the year-round contest for activities of cities in fire prevention conducted by the National Fire Waste Council of the U. S. Chamber of Commerce, the winners for 1944 in the various population classes were Milwaukee, Providence, Wichita, Anderson, Ind., Marietta, Ga., Fort Collins, Colo., with Wichita emerging as the grand winner.

Fire Protection Engineering.

A development during 1945 that was of great interest to fire protection engineers was the adoption by the War Manpower Commission of an adequate and accurate definition of fire protection engineering. That there is a separate and distinct profession of fire protection engineering has not been appreciated or recognized and this official definition will help considerably to bring about such recognition.

Substitute Materials.

During the war a considerable use of substitute materials to replace natural rubber, copper and similar highly critical commodities was necessary. It seems logical that such items as fire hose and electrical insulation, for examples, produced during the war period from substitute materials will not have the normal length of life and that we may have many cases of failure during the postwar period that will tend to increase fire losses. It is still too early to predict just how important this may be. Also in the present period of intense revival of peacetime production many new products and materials will come upon the market. Some of these will inevitably carry with them special fire hazards and all fire protection people must be on the alert to see that such new products and materials do not endanger the lives and safety of the public. As an example of this, considerable attention was aroused last summer in Washington, D. C., when a number of small children were burned to death and seriously injured because they were wearing toy cowboy suits that were extremely flammable.

N.F.P.A. Membership.

During 1945 the National Fire Protection Association broke all previous records for activity and expansion. In June, 1945, the membership of the Association passed the 10,000 mark, thus reaching a long-desired goal. During the year a number of large city fire departments took out memberships in the Association for all of the principal officers and all of the fire stations throughout the city, thus providing effective distribution of the Association's literature to the entire fire department. Following the end of the war the latter months of 1945 showed a considerable expansion of foreign memberships of the Association and a very substantial growth in foreign membership is expected in the next several years. In 1945 for the first time several executive branches of the federal government — War, Navy, Interior and Agriculture — officially affiliated with the N.F.P.A. as organization members.

Publications.

Also during the year all previous records for output of literature from the Association were broken. Never has the demand for printed literature on various aspects of fire protection and prevention been so great as it was in 1945. The fact that because of travel and hotel restrictions the usual annual meeting of the Association could not be held during the year does not seem to have hindered in any degree the activities of the Association. During the latter months of the year a very marked revival of interest in the peacetime work of the many technical committees of the Association was noted and a very active committee year is expected. New committees created during 1945 were the Committee on Public Relations, the Committee on General Storage, the Committee on Places of Outdoor Assembly and the Magnesium Committee. The Association now has 57 technical committees covering the entire wide range of fire waste control activity.

The Association is entering its 50th year at the peak of activity and with a long record of constructive service.

Large Loss Fires Of 1945.

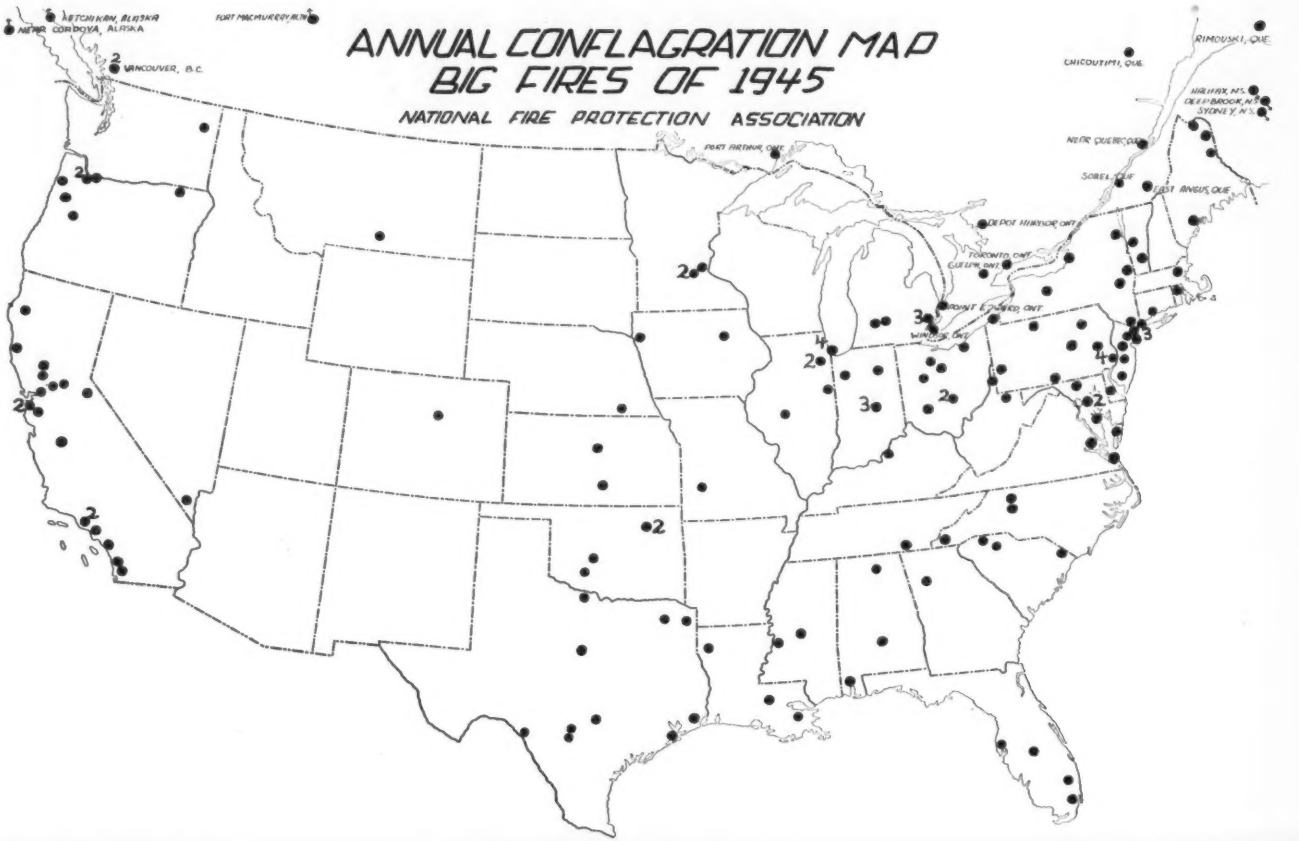
During 1945, 163 fires were reported to the N.F.P.A. Fire Record Department, each of which resulted in a loss estimated or verified to be in excess of $250,000. Only those losses which occurred in the United States, Canada and Alaska have been summarized for this report. In 1945 there was an increase of 41 large loss fires over the 122 reported in 1944, 58 over those reported in 1943, 83 over those reported in 1942, and 115 over those reported in 1941.

Nearly 100 of the large loss fires in 1945 occurred prior to V-J Day and thus affected the nation's military effort. It is possible that Army, Navy and Maritime Commission property, valued in millions of dollars prior to the end of the war, had only salvage value the day the war ended. Too often fire losses in military property just before and following the end of the war are looked upon as convenient surplus property disposal, whether or not justifiable.

There were no new and startling causes for the large loss fires of 1945 except for the bomber crash into the Empire State Building in July and the collapse of the Richmond Naval Air Base blimp hangars during the hurricane in Florida in September.

The summaries and tables for the large loss fires of 1945 on the following pages are arranged by occupancy classifications. The information in the summaries and the table made from the summaries are taken from the best available data that the N.F.P.A. has been able to obtain. Every effort has been made to base the printed information on the established facts. To improve the usefulness of the data to all concerned or interested in it, the N.F.P.A. will appreciate the receipt of specific information regarding factual errors or omissions in the printed summaries. Near the end of the year it is particularly difficult to obtain complete information in time for publication.

Four tables have been prepared, showing the contribution of various factors responsible for large losses. It will be noted that there is a table listing causes, time and plant operation factors and the classifications of large loss fires. In addition, the annual map, showing the locations of large loss fires, appears on the next page. Based on the large loss fire data for 1945, it is useful to consider the prospects for large loss fires in 1946. There is a better than even chance that a representative large loss fire in 1946 will gain such headway before discovery that its cause will remain unknown. The average monetary loss will be $750,000. There is an even chance that the fire will occur in one of the following: a warehouse, multiple occupancy building or in a metalworker. It is highly probable that there will be a heavy concentration of valuable contents in a building of inferior construction and large undivided areas. If the building in which the representative 1946 large loss occurs is multi-story, it is almost certain to have unprotected openings in the floors. There is a much higher than even chance that the building will have inadequate private protection, either from sprinklers, automatic fire alarms or supervised and able watchmen. There is just less than an even chance that the representative large


ANNUAL CONFLAGRATION MAP
BIG FIRES OF 1945
NATIONAL FIRE PROTECTION ASSOCIATION
KETCHIKAN, ALASKA
NEAR CORDOVA, ALASKA
FORT MACMURRAY, ALTA.
VANCOUVER, B.C.
PORT ARTHUR, ONT.
CHICOUTIMI, QUE.
RIMOUSKI, QUE.
HALIFAX, N.S.
DIGBY, N.S.
SYDNEY, N.S.
NEAR QUEBEC, QUE.
SOREL, QUE.
EAST ANGUS, QUE.
DEPOT HARBOR, ONT.
TORONTO, ONT.
GUELPH, ONT.
POINT EDWARD, ONT.
WINDSOR, ONT.

Where Large Loss Fires Occurred.

Central States 32
- Illinois 8
  - Chicago (4)
  - Danville
  - †(1) Joliet (2)
  - Springfield
- Indiana 5
  - Indianapolis (3)
  - LaFayette
  - Muncie
- Kentucky 1
  - Louisville
- Michigan 5
  - Battle Creek
  - Detroit (3)
  - Kalamazoo
- Minnesota 3
  - Minneapolis (2)
  - St. Paul
- Ohio 8
  - Cleveland (2)
  - *Clyde
  - Columbus (2)
  - †Dayton
  - †Fremont
  - Lima
- West Virginia..... 2
  - Fairmont
  - Wheeling

Middle Atlantic 31
- Delaware 1
  - †*Cheswold
- Maryland 4
  - Baltimore (2)
  - Hagerstown
  - *North Beach
- New Jersey..... 4
  - Clifton
  - *Malaga
  - Morristown
  - *Pemberton
- New York.....11
  - Bronx
  - Brooklyn
  - New York City (4)
  - †*North Hoosick
  - *Port Henry
  - †Sampson
  - Syracuse
  - Voorheesville
- Pennsylvania 11
  - Bethlehem
  - Erie
  - Forty Fort
  - *Greencastle
  - Mahanoy City
  - McKeesport
  - Philadelphia (4)
  - *Port Allegany

Mid West 6
- Iowa 2
  - *Independence
  - †Sioux City
- Kansas 2
  - Fort Riley
  - †Wichita
- Missouri 1
  - Springfield
- Nebraska 1
  - Beatrice

New England 9
- Connecticut 1
  - West Haven
- Maine 4
  - Caribou
  - *Fort Kent
  - Portland
  - Presque Isle
- Massachusetts 1
  - Tewksbury
- Rhode Island..... 1
  - Woonsocket
- Vermont 2
  - Bellows Falls
  - Rutland

South 9
- Alabama 3
  - *Dozier
  - Huntsville
  - †Mobile
- Louisiana 3
  - Jefferson Parish
  - Lafayette
  - Shreveport
- Mississippi 2
  - Jackson
  - *Waters
- Tennessee 1
  - Chattanooga

Southeast 14
- Florida 4
  - *Dunedin
  - Lake Wales
  - Miami
  - †Richmond
- Georgia 1
  - North Atlanta
- North Carolina..... 3
  - Fontana Dam
  - Lexington
  - Winston-Salem
- South Carolina..... 3
  - Greenville
  - *Mullins
  - Spartanburg
- Virginia 3
  - Alexandria
  - *Cheriton
  - Norfolk

Southwest 14
- Oklahoma 4
  - Altus
  - Hobart
  - Tulsa (2)
- Texas 10
  - *Atlanta
  - *Chillicothe
  - †Del Rio
  - Fort Worth
  - *Fratt
  - †*Pittsburg
  - Port Arthur
  - San Antonio
  - Seguin
  - Texas City

West 29
- California 18
  - *Arbuckle
  - *Biola
  - *Emeryville
  - †Fairfield
  - Humbolt County
  - Long Beach
  - Los Angeles (2)
  - †Los Angeles County
  - National City
  - Oakland
  - †Sacramento
  - San Diego County
  - San Francisco (2)
  - *Sonora
  - *Williams
  - *Willits
- Colorado 1
  - Denver
- Montana 1
  - Billings
- Nevada 1
  - †Las Vegas
- Oregon 7
  - *Dundee
  - Pendleton
  - †(2) Portland (3)
  - Salem
  - Tillamook County
- Washington 1
  - Spokane

Alaska 2
- †Cordova
- Ketchikan

Canada 17
- Alberta 1
  - Fort McMurray
- British Columbia..... 2
  - Vancouver (2)
- Nova Scotia..... 3
  - *Deep Brook
  - †Halifax
  - †Sydney
- Ontario 6
  - Depot Harbor
  - Guelph
  - *Point Edward
  - Port Arthur
  - Toronto
  - Windsor
- Quebec 5
  - Chicoutimi
  - *East Angus
  - †Quebec
  - Rimouski
  - Sorel

TOTAL 163

*Indicates locations under 5000 population. †Indicates locations outside city limits.

Factors Responsible for Large Losses.

	Warehouses	Multiple Occupancies	Metal-workers	Sawmills, Woodworkers	Food Processing	Mercantile Group Fires	Mills and Elevators	Hangars	Misc. Industrial	Others	Totals
Structural Factors											
Inferior construction, excessive area	27	20	14	8	8	7	6	..	4	20	44
Insufficient exposure protection	9	4	3	8	3	5	5	..	2	10	49
Unprotected vertical openings	4	19	3	2	4	4	3	..	2	6	47
Occupancy Factors											
Quick burning contents	23	16	10	9	4	7	7	6	4	25	111
Flammable liquids and gases	6	3	10	..	4	1	..	6	1	15	46
Unsafe heating equipment	3	1	..	..	..	..	..	..	..	2	6
Contents of unusually high value	2	..	3	..	..	..	..	1	1	5	12
Congested contents	9	5	2	..	..	..	..	2	0	2	20
Concentration of high values	14	..	4	1	1	..	..	3	1	6	30
Fire Protection											
Unprotected multiple occupancy mercantile basements	..	9	..	..	..	..	..	..	..	..	9
Inadequate private protection	35	17	15	6	7	3	6	5	4	18	116
Lack of fire doors or cutoffs between sections	18	13	11	1	8	2	3	..	3	12	71
Fire doors blocked open or otherwise inoperative	2	..	..	..	..	..	..	..	..	1	3
Inadequate public protection	14	..	4	3	5	5	..	1	2	6	40
Sprinkler system shut off	1	1	..	..	..	..	2	..	..	..	4
Sprinkler system parts failure	1	..	..	..	..	..	..	..	..	..	1
Inadequate sprinkler maintenance	1	1	1	2	..	..	..	..	..	1	6
Excessive hazards for sprinkler protection	..	1	1	2	1	..	..	..	..	1	6
Fire Fighting											
Fire difficult of access	4	6	1	..	..	1	1	..	..	4	17
Poor fire fighting	..	..	1	..	..	..	..	..	..	..	1
Fire department inadequately manned or equipped	..	1	..	..	1	4	1	1	1	4	13
Inexperience with large fires	14	2	..	4	4	4	1	..	..	3	32
Fire department delayed	1	1	..	..	..	..	..	..	..	1	3
Delay in Alarms											
Headway established when fire discovered	23	21	3	2	5	5	3	..	3	11	76
Effort to extinguish without alarm	1	3	5	3	..	..	1	..	..	5	18
No public alarm system	13	9	3	1	1	1	..	..	1	2	31
No watchman service	12	16	..	..	1	3	2	..	..	6	40
Failure watchman service	3	2	1	..	..	..	1	..	1	3	11
Water Supplies											
Inadequate water supply	7	2	3	6	4	2	2	..	2	7	35
Shortage of hydrants	5	1	3	2	2	..	1	1	1	2	18
No approach to static water supply	2	1	..	..	..	1	1	..	..	..	5
Hydrants too close to fire	1	..	..	..	..	..	..	..	..	..	1
Weather Conditions											
Strong winds	8	1	2	1	..	3	..	1	1	4	21
Extreme cold	..	2	..	..	1	2	..	..	1	1	7
Explosions											
During fire	4	..	3	1	1	..	5	3	..	10	27

The above table is an analysis of the factors responsible for large losses in 1945. In most fires two or more factors contributed to the spread of fire and the excessive loss which resulted.

loss fire will occur in a building in an unprotected location or with public protection facilities inadequate through lack of manpower, equipment or water supplies. It is also probable that accidents or careless handling of flammable liquids will contribute to the large loss. If the large loss of 1946 occurs in or near by a community where large fires are infrequent or have never before occurred, it is very likely that inexperience in handling large fires may contribute to the extent of the fire. Insufficient protection against exposures will figure in the analysis of large loss fires in 1946 considered on the evidence obtainable in the 1945 data.

It is to be hoped that the prevalence of fires in 1945 traceable to lack of knowledge on the part of plant managements in their introduction of serious special and highly hazardous processes without adequate safeguards, supposedly made necessary by the requirements of the armed services during the war, will be eliminated in 1946. As an example, the use of large quantities of paraffin wax for protection of metal parts and bomb cases against corrosion contributed to the rapid spread of fires which were impossible for sprinkler systems or public fire protection agencies to control.

Causes of Fires.

Electrical defects	14
Welding and/or cutting operations	11
Careless smoking and matches	8
Defective heating	6
Ruptured piping — flammable liquids or gases	5
Spontaneous ignition	4
Rubbish handling	4
Arson	3
Lightning	3
Suspicious	2
Sparks from railroad engine	2
Overheated bearings — woodworkers	2
Crashed aircraft	2
Exposure	1
Overheated air compressor exhaust	1
Fire-packed cotton bale	1
Defective gas water heater	1
Sparks from ragpicker	1
Following drinking party	1
Hot stampings — oil quenching tank	1
Nitrate bath explosion	1
Valve leak ammonia explosion	1
Oil heated oven backfire	1
Dust explosion	1
Hurricane	1
Electrical short circuit	1
Flammable solvent — overheated degreasing vat	1
Back gasoline lift truck	1
Ship collisions	1
Nitriding furnace	1
Munitions explosion	1
Unknown	79
Total	163

The large loss fires of 1945 covered a wide variety of occupancies, but only a portion of the occupancies vulnerable to large-scale destruction by fire are listed among them. (See table on next page.)

Time and Plant Operation Factors in Large Losses.

Occupancies	Midnight to 6:00 A.M.	6:00 A.M. to Noon	Noon to 6:00 P.M.	6:00 P.M. to Midnight	Plant in Operation	Plant Not in Operation	Total
Warehouses	7	4	5	13	12	17	29
Multiple occupancies	11	5	2	7	3	22	25
Metalworkers	4	4	4	4	14	2	16
Sawmills, lumber yards, etc.	0	2	6	1	6	3	9
Food processing	5	2	0	1	1	7	8
Mercantile group fires	3	0	1	2	2	4	6
Mills and elevators	3	2	0	2	1	6	7
Airplane hangars	1	0	2	1	3	1	4
Misc. industrial	0	1	1	3	2	3	5
Others	14	10	3	4	21	10	31
Totals	48	30	24	38	65	75	140

Classification of Large Loss Fires.*

Occupancy or Type of Fire	No. of Fires Sub Totals	No. of Fires Totals	Dollar Loss Sub Totals	Dollar Loss Totals
Aircraft hangars	..	6	.....	$36,375,000
Warehouses	..	37	.....	22,835,000
Cotton	6	..	$3,275,000	.....
Grain, food, tobacco	6	..	3,350,000	.....
General storage	5	..	3,250,000	.....
Military	4	..	2,800,000	.....
Cold Storage	3	..	1,625,000	.....
Paper	2	..	725,000	.....
Furniture	2	..	705,000	.....
Special hazard occupancy within	2	..	680,000	.....
Metalworkers	..	17	.....	10,835,000
Multiple occupancies	..	26	.....	9,135,000
Various mercantile stores	7	..	2,320,000	.....
Theatre, mercantile stores, offices and apartments	4	..	1,375,000	.....
Restaurant and mercantile stores	3	..	1,205,000	.....
Mercantile stores and apartments	4	..	1,120,000	.....
Textile manufacturing	1	..	1,000,000	.....
Warehouse and manufacturing	2	..	540,000	.....
Offices and mercantile stores	2	..	500,000	.....
Warehouse and mercantile stores	1	..	500,000	.....
Hotel and mercantile stores	1	..	315,000	.....
Truck terminal and warehouse	1	..	260,000	.....
Piers and shipyards	..	4	.....	7,900,000
Food processing plants	..	9	.....	4,810,000
Sawmills, lumber yards and woodworkers	..	9	.....	4,680,000
Steamships	..	4	.....	4,300,000
Mills and elevators	..	7	.....	3,375,000
Forest fires	..	3	.....	2,550,000
Mercantile group fires	..	6	.....	2,350,000
Laundries and dry cleaning plants	..	3	.....	1,875,000
Rubber manufacturing operations	..	4	.....	1,675,000
Miscellaneous industries	..	5	.....	1,450,000
Recreation buildings	..	4	.....	1,360,000
Refineries	..	3	.....	1,325,000
Conflagrations	..	2	.....	1,300,000
Miscellaneous public buildings	..	4	.....	1,120,000
Truck terminals	..	3	.....	935,000
Paper mills and processes	..	2	.....	690,000
Chemicals plants	..	2	.....	670,000
Empire State building disaster	..	1	.....	500,000
Textile industry	..	1	.....	295,000
Halifax, N. S., munitions explosion	..	1	.....	Unestimated
Total		163		$122,340,000

*The above loss figures are either estimates by local authorities or verified from responsible sources.

Large Loss Fires of 1945.

Aircraft Hangars.

Feb. 15, Sydney, N. S. Airplane Hangar. $625,000.

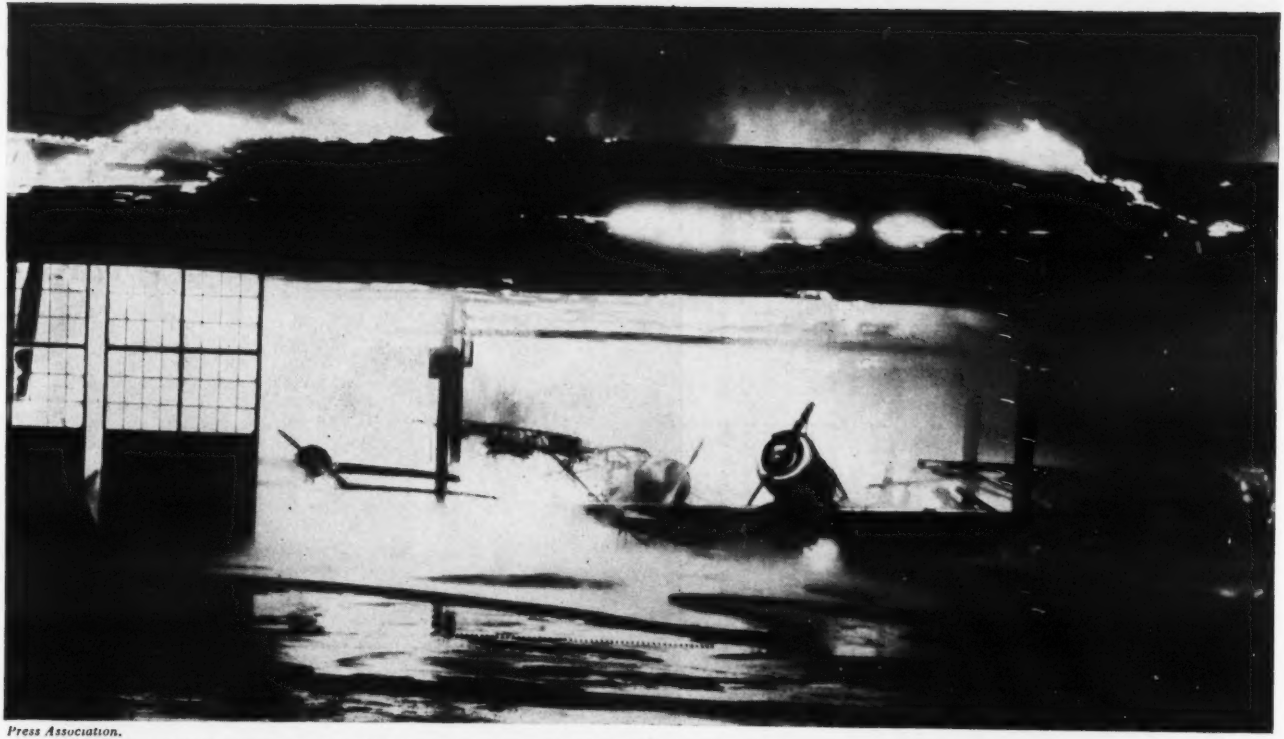
An explosion of unrevealed origin in a Canadian Air Force hangar killed four men and injured thirteen others. The building was 30,375 sq. ft. in area of wood on steel truss construction, with concrete floor. The Post Fire Department used 13 hose streams from hydrants supplied by fire pumps taking suction from artesian wells. Buildings completely down in 40 minutes.

Mar. 6, near Dayton, Ohio. Modification Hangar. $3,000,000.

A cargo plane taking off from Wright Field became airborne, suddenly swerved out of control, and crashed into a concrete modification hangar. Eight men were killed and nine others were injured. Approximately fifty persons were working in the hangar at the time (1:30 P.M.). The plane struck through partially open steel hangar doors, approximately 4 ft. above the ground, immediately bursting into flame, and involving two other planes, a B-29 and P-51 parked inside the hangar. An explosion resulted and gasoline from the three planes caused a general fire in the unsprinklered concrete hangar, involving six other planes, including a highly valuable experimental model. Alarm was given through an automatic box, and prompt fire fighting by air field and municipal firemen limited damage to one bay of the hangar. Nine engines, 1 ladder and 5 crash trucks responded and used 18 hose streams in addition to 12,000 pounds of CO_2 and 1200 gallons of foam. Gasoline sprayed on the floor of the hangar and localized explosions in three aircraft gasoline tanks contributed largely to the spread of the fire. Difficulty in extinguishing magnesium alloy aircraft parts caused numerous reignitions of pools of gasoline. Cinder block walls separating the bays of the modification hangar were instrumental in preventing extension of fire outside the bay.

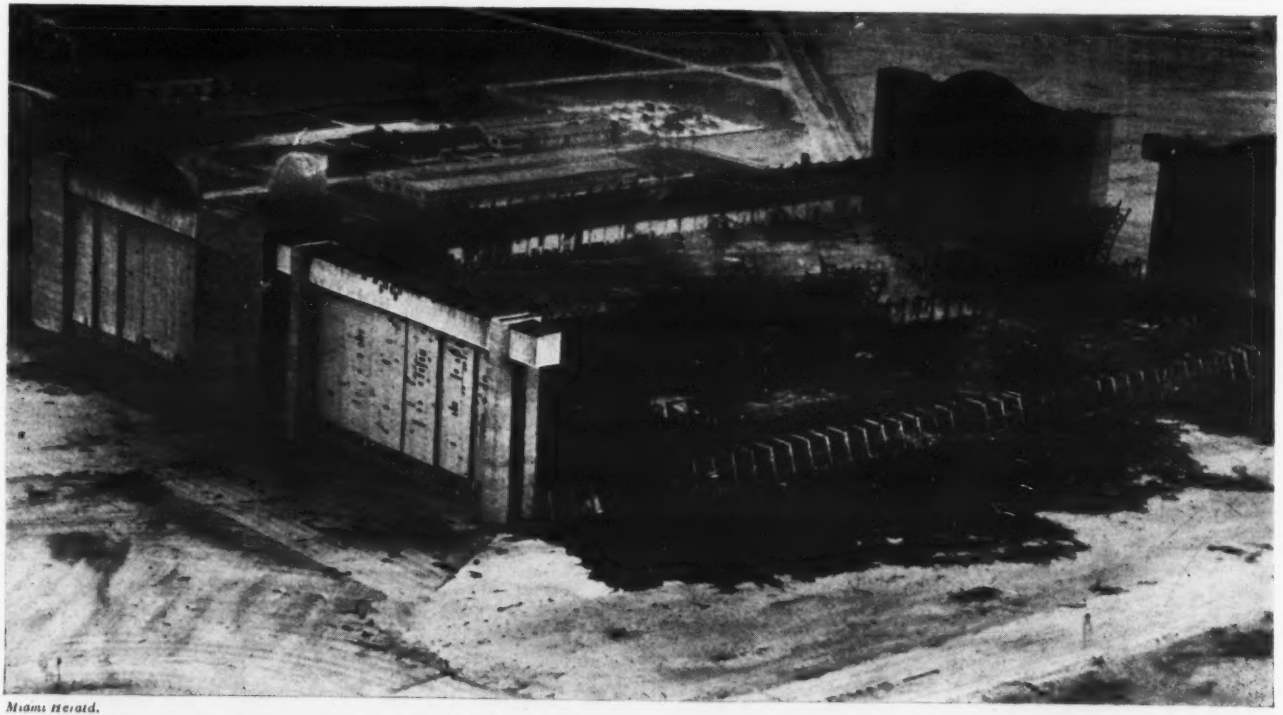
Acme.

Eight men were killed, nine injured, and highly valuable aircraft were destroyed when a cargo plane out of control struck a concrete modification hangar at Wright Field, Dayton, Ohio, on March 6.



Press Association.

The burning of this hangar at the Wichita, Kansas, municipal airport, September 26, caused a loss of $75,000 to the 28,000 sq. ft. hangar building. Twenty-eight planes were destroyed, with a loss of $495,000. Automatic sprinklers had been recommended, but funds had been sufficient only for a reservoir.



Miami Herald.

Aerial view of two of the three hangars wrecked in the hurricane at the Richmond Naval Air Station, near Miami, Florida, Sept. 15, 1945. Fire, following collapse of the hangars, destroyed 366 Navy planes, 25 blimps, and 150 automobiles. Note the unburned flameproofed wood wreckage on the ground outside the hangar floor of the nearest hangar in the photograph. Partially burned or undamaged treated timber trusses and plank sheathing can be seen throughout the ruins.

May 13, Sioux City, Iowa. Hangar. $1,000,000.

Details on this important fire at an Army Air Base have not been made available. One source indicates that a gasoline tank dropped from a plane undergoing servicing and exploded. Fire involved combustible insulation on the inner surface of the hangar which could not be reached effectively with the fire equipment available at the Base. City response was made upon request and the fire was extinguished before the hangar collapsed despite buckling of unprotected, steel-supporting members. One large plane was completely destroyed and damage done to three or four others, as well as to a number of dismounted aircraft engines on stands.

Aug. 17, Del Rio, Texas. Army Aircraft Hangar. $1,250,000.

A fire, discovered about 3 A.M., destroyed the Production Line Maintenance Hangar at Laughlin Field and five twin-motored bombers parked in the structure. Several other planes, on hardstands adjacent to the hangar, were also damaged. City equipment assisted the field's fire fighters in controlling the flames, but the building was lost because of the rapid spread of the fire. While no one was injured, the loss was estimated as "several millions" by the Commanding Officer, according to press reports released by the Public Relations Office of the Field. No information on cause was officially given.

Sept. 15, Richmond, Fla. Naval Air Station. $30,000,000.

Fire followed the collapse of three large dirigible hangars at the Richmond Naval Air Station during the September hurricane. While anemometers at the station were inoperative at peak wind velocities, at the time of collapse, meteorological data indicate winds reached 196 m.p.h. for a few seconds and at least 155 m.p.h. as a five minute average. The hangars, each covering seven acres of ground, housed some 360 Navy planes and 150 automobiles at the time, and the origin of fire is believed to have been ignition of flammable gasoline vapors from the damaged aircraft, probably ignited by electrical short circuits in the planes, cars, or buildings. (See October, 1945, QUARTERLY, pages 89-93.)

Sept. 25, Wichita, Kans. Airplane Hangar. $495,000.

Twenty-eight airplanes, crowded with overlapping wings into the 30,000 sq. ft. area of Wichita Municipal Airport Hangar No. 1, were destroyed along with the building by a fire originating from a short circuit of battery cables in a small, fabric-covered plane stored on its nose in one corner of the structure. Discovered about 11:00 P.M., employees attempted to knock down the flames with hand extinguishers, but were unsuccessful, and the foreman then ordered one man to call the fire department while others removed a fire truck (500 g.p.m. pumper) from the building and drove gasoline tank trucks (parked 50 ft. south of the hangar) from the danger zone. When the full gasoline tank of the plane exploded, fire spread to other aircraft, and only one plane was removed, as orders were given not to open doors because of drafts. Fire equipment from the city reached the scene at 11:22 P.M. as the field employees were attempting to draft water from a 200,000 gallon reservoir located 150 ft. from the hangar. By 11:25 four companies from Wichita, two from the Planeview War Housing development, and two from Boeing Aircraft were pouring water on the hangar, but the fire was beyond control, fed by exploding gas tanks, combustible planes and the wood-joisted roof. The city had seriously considered installing automatic sprinklers in this hangar in 1940, but assistance from the Federal Government was not available and the project was canceled for lack of funds. However, in 1944 a reservoir was built as part of a program to provide fire protection to the Airport area. The 500 g.p.m. pumper and a chemical truck (destroyed in the fire) were the only other protection afforded by the city owners on the airport. One of the contributing factors of interest in this disaster was that the airplane first involved had a full load of gas with a gas-tight cap, permitting the building-up of high pressures from the excessive heat of the fire.

Warehouses.

Jan. 3, Muncie, Ind. Warehouse. $375,000.

Fire occurred in the paper storage section of this large two-story, brick, concrete and steel-framed structure. The building owned by the Ball Bros. Co. had a frontage of 300 ft., a depth of 450 ft. and a width of 200 ft. in the rear. This large area was without sprinkler protection and had no fire divisions or cutoffs. Employees telephoned the alarm at 10:13 P.M. when an overheated air compressor exhaust pipe which extended through the second floor and roof started the fire. Two manual alarm boxes on a supervised watchman service system were pulled at 10:15 and 10:17 P.M. Although the building was of incombustible construction, the large area and highly combustible contents made it impossible for the firemen to reach the center of the flames, as hose streams could not penetrate more than 50 ft. on all sides. Thus, a nearly total loss resulted. Firemen were able to save near-by structures.

Jan. 9, New York, N. Y. Household Furniture Storage Warehouse. $345,000.

A spectacular fire, accompanied by explosions, in a 6-story unsprinklered brick-joisted Lee Bros. furniture storage warehouse in the Harlem section of New York City, caused the deaths of two firemen when a wall fell outward. The explosion, which blew out the upper front wall and caved in the roof, occurred just after a Fire Patrol truck had pulled out of the spot on which the wall fell and killed the firemen. The cause of the fire was not determined.

Jan. 27, Brooklyn (New York), N. Y. Newsprint Paper Warehouse. $350,000.

Fire of unknown origin occurred on the third floor of the Richards & Bowne Co. large unsprinklered warehouse of four-story brick, plank and timber construction, containing stored newsprint, and extended to the fourth floor through pipe openings. It was discovered by a pedestrian, who pulled a city fire alarm box. Fire did not spread to a four-story reinforced concrete building adjoining, with communicating openings protected by standard fire doors. The fire department responded with numerous hose streams to four alarms. A battalion chief collapsed as a result of heat and smoke while reconnoitering the building and died en route to the hospital.

International News.

Falling wall and debris killed two firemen at the Lee Bros. Warehouse, New York City, on January 9, when explosions occurred following a fire of undetermined origin.

International News.

The ruins of the warehouse and spray-painting building of the Walker Electrical Co. near Atlanta, Ga., after a $375,000 fire on January 30. Working on war orders, this building was highly congested and had no automatic sprinklers or subdivision of hazardous processes.

Jan. 29, North Atlanta, Ga. Electrical Equipment Warehouse and Spray Painting. $378,074.

Fire originated at 8:20 P.M. in a spray booth in the Walker Electrical Co. one-story unsprinklered wood frame metal-clad warehouse building located outside the city limits of Atlanta, Ga., adjacent to the main sprinkler protected building of this plant. At the time of the fire, paint spraying operations in booths in the south-center portion of the unsprinklered warehouse building had been suspended for about half an hour. Employees in other portions of the building noticed rapidly spreading fire in the area of the spray booths. At the time of the fire the building destroyed was seriously congested by storage of metal shell containers, electrical panel boards and stock in process which was not cut off from the process of paint spraying, dipping and drying, electroplating, wood crate making and packing. Public fire departments responded to a telephone alarm and were successful in confining the fire to the building of origin. About $100,000 worth of light sheet steel in unsprinklered frame, metal-clad storage building near by and adjoining the main sprinklered building was undamaged by the fire. Loss $378,074.

Following the first fire, an all-metal spray booth was installed outside of and adjoining an unsprinklered addition to the main sprinklered building. On May 28, at 5:15 P.M., after spraying operations were suspended, an employee had just finished cleaning the spray booth interior with a wooden scrape and was sweeping the residue into a pile when, according to an eyewitness, the residue burst into flames. The public fire department responded to a telephone fire alarm and confined the fire to the unsprinklered addition to the main sprinklered building. Loss $29,000.

Still a third fire, originating in a spray booth, occurred at this plant on June 4 at 12:10 P.M. about ten minutes after paint spraying operations had been suspended. The fire was again discovered by an employee. The public fire department was summoned by telephone and confined the fire to the unsprinklered storage addition, though the loss was $45,000. Several drums of paint, lacquer and thinner were in the yard within twenty feet of the spray booth, but were kept wet down by hose streams and were not involved in the fire.

At the time of these fires, the plant management was convinced that spontaneous ignition of paint residue was the cause of all three fires and succeeded in having the paint specifications changed. Smoking was not permitted near paint spraying operations, but was permitted in the plant yard, and a carelessly discarded cigarette or lighted match could have caused these fires. The second fire could have been caused by a spark during cleaning operations. These fires further demonstrate the severe hazards incident to paint spraying operations, and the possibility of large fire losses when operations are conducted in unsprinklered areas exposing high values.

Feb. 1, Indianapolis, Ind. N. Y. C. Freight Depot. $300,000.

Fire, started at 12:50 A.M. by an explosion of bituminous coal gases in a magazine type stove in the foreman's office, destroyed a large freight depot. This building was a one- and one-half story, steel and brick, wood-roofed structure, 700 ft. by 120 ft. In addition to total destruction of the building and contents, including the plank and timber loading docks on both sides of a driveway the full length of the structure, the fire also spread to several box cars located a short distance east of the building. The fact that bills of lading were burned and that the depot was a distributing point where cars were reloaded for redistribution added unusual complications. Several firemen, including the chief of the department, were injured. Dynamite caps, small arms ammunition, and gasoline from twenty-five trucks stored in the structure added to the hazards of the fire.

Feb. 9, near Mobile, Ala. Insulation Warehouse and Veneer Drying Shed. $294,672.

Fire occurred about 5:00 P.M. soon after close of day's operation in a large unsprinklered frame warehouse building occupied by the Reilly-Benton Company, Inc. The fire was discovered by an employee. The cause is not definitely determined, but the fire is believed to have started from a defective butane gas room heater. Fanned by a strong wind, the fire spread rapidly over the large frame building, and completely destroyed the building and contents, consisting of large amounts of rock wool, asbestos cement and fibre glass insulating materials in cardboard cartons. Fire leaped 60 ft. from the burning warehouse to a frame metal-clad dryer building of the Danner Veneer Company, completely destroyed the building except for an all-steel portion of it, and practically ruined the large all-metal, veneer drying machine. This all-metal portion was a factor in preventing fire from reaching a frame metal-clad boiler house 8 feet from the dryer building. The fire department of the City of Mobile responded to a telephoned alarm with three engine companies and the Coast Guard and

Seven warehouses near Joliet, Ill., were destroyed by fire on February 19. Outside the city limits, there was no adequate public water supply and no automatic sprinklers or other suitable private protection.

Maritime Service responded with five fire boats. Both pumpers and fire boats took suction from the adjacent Three Mile Creek, and firemen, using a large number of hose streams, were able to prevent the spread of fire to other frame ironclad buildings of this plant.

Feb. 19, near Joliet, Ill. Multiple Occupancy Storage Warehouse. $297,000.

This plant, without public water supply, owned by Joliet Industries, located outside the city limits of Joliet, comprised a large group of unsprinklered one- and two-story buildings of ordinary brick, stone and frame construction separated into three major fire areas, exposing each other, with various buildings in the group separated in sections by brick division walls with openings not properly protected. Seven buildings in the group were totally destroyed by fire, discovered at 10:30 P.M. by the night watchman. The buildings were occupied by three firms storing roofing materials, wall paper and baled waste cork. The Joliet Fire Department, Lockport and East Joliet Fire District Departments responded to a telephone alarm received at 10:40 P.M. Exact cause of the fire is unknown. There was a coal stove on unprotected wood plank floor with a metal smoke pipe extending through a ceiling, concealed space and roof with 6 inches clearance, and also an electric charging machine for recharging electrical loading trucks in the section of origin. On arrival of the first department, the plant private water supply was found to be of little value, and the second department to arrive proceeded to a hydrant available at a near-by industrial plant. Twenty-four hundred feet of 2½-in. hose in three lines were laid, with good pressure. Power lines to the pump house of the private water system in the Joliet Industries plant were cut off early in the fire and water supply was not restored until a pump was provided, and this supply was useful only in extinguishing roof fires on adjoining buildings, which were saved by the combined effort of the three departments.

Mar. 8, Greencastle, Pa. Shipbuilding Machinery Warehouse. $2,100,000.

Fire of unknown origin, starting in a frame addition, totally destroyed a warehouse used by the Bethlehem-Fairfield Shipyard in Baltimore for the storage of shipbuilding machinery, pumps and other ship equipment until needed at the shipyard. The structure was one-equal-two story in height, with brick walls, plank roof on unprotected steel columns and trusses. A watchman telephoned an alarm at 6 P.M. and 3 volunteer fire companies used 6 hose streams in confining the fire to this unsprinklered building of more than 26,000 sq. ft. area. Loss to building estimated at $100,000 and loss to contents owned by the U. S. Maritime Commission estimated to have been well in excess of $2,000,000.

April 9, New York, N. Y. General Storage Warehouse. $2,000,000.

A stubborn, smoky fire broke out at 9:00 A.M. and gutted the five-story, unsprinklered, mill constructed, 125 x 110 ft. Tower's Warehouse on New York's waterfront, bringing 38 pieces of apparatus to the scene. Blank walls on three sides hampered fire fighters, who were restricted to windows on the front side and to such openings in the roof as could be made before smoke forced withdrawal. The cause has been attributed to an electrical defect, because of the opening of the neutral of a three-wire system with an unbalanced lighting circuit which caused excessive voltage to at least one incandescent light bulb. The theory is that the bulb broke and dropped the hot filament upon combustible material in storage. Twelve workmen in the building escaped injury, although a score of fire fighters required first aid. Included in the bonded and free storage was a large quantity of impounded Japanese toys and novelties, U. S. Army Quartermaster clothing, many cases of Scotch whiskey, bottled beer, barrels of rum and foodstuffs. Tightly packed stock, tiered to the ceiling, was so close to the front windows that it created a barrier to the high pressure hose streams. Over 8,000,000 gallons of water were used; maximum volume was at 11:00 A.M. when 19,200 g.p.m. were being discharged at hydrant pressures of 175 p.s.i.

International.

Tower's warehouse fire, April 9. Blank walls on three sides limited access for fire fighting to the front.

April 14, Huntsville, Ala. Cotton Warehouse. $800,000.

Failure of a six-inch dry valve (rendering automatic sprinkler protection of no value), substandard brick walls of questionable resistance without building sprinkler protection (due to valve failure), and the location of an elevated water tank adjacent to the structure contributed to the large loss in this fire at the Dixie Warehouse and Storage Company plant. Approximately 6000 bales of cotton in three sections (totalling 35,000 sq. ft.) of the warehouse were destroyed. The one-story construction was a combination of twelve-inch brick, frame-metal clad and frame walls, with composition roof. Sprinklers in exposed and adjacent sections operated successfully and others were tripped manually by fire fighters. Despite prompt arrival of firemen following the 5:12 P.M. alarm, flames were well advanced and full attention had to be concentrated on limiting spread to other compartments and a detached exposed warehouse across a driveway. When the plant's elevated water tank collapsed from the heat of the fire, diminished secondary water supplies to all sprinklers had to be completely cut. Nine vital hose streams absorbed the entire primary source. Cotton storage on an outside platform between two of the sections involved, partially open fire doors and crowded warehouse conditions are believed contributing factors to the spread of fire. Boys playing in an unsprinklered area underneath wood flooring may have started the fire.

April 23, Voorheesville, N. Y. Army Warehouse. $1,000,000.

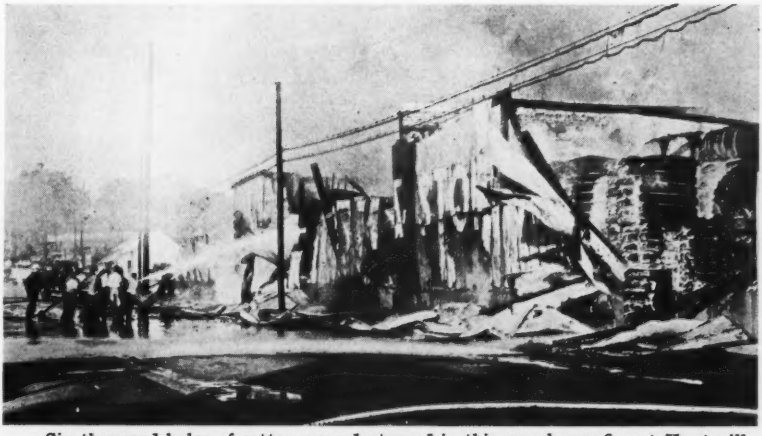
Little information has been released on this major fire at the Army's Voorheesville Holding and Reconsignment Point, which destroyed a section of an unsprinklered warehouse. Public fire departments from Albany and four suburban communities were called to assist the Depot Fire Department. The warehouse had exterior walls of brick with light wood roof and was one-story high. Fire walls are said to have checked the spread to other sections.

May 7, near Las Vegas, Nev. Temporary Warehouse and Office. $250,000.

A serious fire occurred at 7:30 P.M. in a large high-story building of all steel construction at the Basic Magnesium Plant during temporary occupancy by a construction company which was remodeling another portion of this Defense

Woonsocket, R. I., Call.

Rubber products and other materials important to the war effort were destroyed in this $300,000 fire in Woonsocket, R. I., on May 27, 1945. Automatic sprinkler protection for manufacturing buildings had been discontinued. Forty hose streams were used but could only protect surrounding property.



Six thousand bales of cotton were destroyed in this warehouse fire at Huntsville, Ala., on April 14.

Plant Corporation property. The large loss has been attributed to lack of automatic sprinklers, delayed discovery, and the quick burning qualities of the asphalt coating of the corrugated metal walls and roof. Limited information does not include the cause of the fire, but indicates that a small one-story frame office building had been constructed within the original structure and that watchman service was not maintained. Construction plans, the contractor's tools, equipment and office records were destroyed.

May 16, Los Angeles, Calif. Furniture Storage Warehouse. $360,000.

The 10,000 sq. ft. undivided storage space on the second floor of the nine-story, steel and concrete, unsprinklered Bekins Van and Storage Warehouse was solidly packed with furniture. Employees were working on the eighth floor at 8:00 A.M. when one remarked that he smelled smoke. A floor by floor survey was immediately initiated and upon arrival on the second floor, smoke was so thick that the fire could not be seen. A telephone alarm was sent to the City of Los Angeles Fire Department. Severely hampered by blocked-off window spaces, which limited access to 5 windows and one enclosed stairway and freight elevator, fire fighters with breathing apparatus reached the fire, but were unable to get it under control before the heat became unbearable. Extinguishment operations were therefore limited to volume discharges of water after a forced entrance had been made through steel sash windows. Thirty-five firemen required hospital treatment for burns of the eyes, exhaustion and other injuries. Cause was attributed to careless disposal of a cigarette just outside a rest room where limited smoking was permitted. Fire doors on stair wells and elevator openings limited the loss to one floor.

May 27, Woonsocket, R. I. Multiple Occupancy —Warehouse. $300,000.

A 2:19 A.M. fire totally destroyed four multistory communicating buildings, caused heavy damage to a fifth, and consumed stored stocks of cotton, wool and rayon wastes, plus drums of chemicals for the production of "plastics," solvents, latex and black lacquer. All the buildings had once been protected by automatic sprinklers, but these had been shut off in 1931 when the heating was eliminated, with the termination of former machine shop operations. Only one building of the entire group of eight retained automatic sprinkler service, and, in this fire, the operation of a few heads at exposed points successfully checked the flames, preventing damage to its contents. The structures were chiefly brick and stone, with plank and timber floors and roofs. Although most vertical and horizontal openings between buildings and floors had standard single fire doors, these were open. Broken windows created serious draft conditions and aided the spread of flames. The fire is believed to have started on the second floor of a three-story section, possibly from spontaneous ignition of low grade or oily waste. (A total of 390,000 lbs. of cotton waste in bales and bags was known to have been stored on this floor, plus unknown quantities of wool and rayon wastes.) Explosions of

Carl Bigelow.

Food for the Army went up in flames in this fire of undetermined origin which destroyed a 50,000 sq. ft. section of an unsprinklered, frame warehouse at Oakland, Calif., on June 8.

solvents on the first floor also contributed to the spread of fire until the collapse of the floor above buried the drums under tons of wet waste. Forty hose streams were in use at the height of the fire, which took ten hours to control. Local fire fighters were aided by firemen from near-by communities.

June 8, Oakland, Calif. Army Warehouse. $500,000.

An unsprinklered frame, one-story warehouse, divided into five sections by heavy plank walls, caught fire from an undetermined cause and destroyed one entire section of approximately 50,000 sq. ft. Valuable foodstuffs for the Pacific war area were lost. Fifteen public and Oakland Army Base pumpers confined the flames to the one section of the 1390 ft. x 175 ft. structure. Shortly before this fire automatic sprinklers were authorized for this building by the War Department.

June 10, Williams, Calif. Farmers' Warehouse. $250,000.

High winds fanned a 4:30 P.M. fire in the Farmers' Warehouse, threatening the entire business district of this California community as sparks showered over a wide area. The warehouse, built in 1920, was 482 ft. long and 150 ft. wide, of frame construction. Some 40,000 bags of grain were in storage at the time. The only theory as to cause is that a spark from a railroad train ignited the structure. A drier, 165 ft. x 63 ft. and seven freight cars were also leveled, and the roofs of a garage, a theatre, and six houses suffered small damage. The local fire department was aided by equipment from four other communities, the Forest Service and State Fire Control headquarters in Maryville.

June 16, Chillicothe, Texas. Cotton Warehouse. $325,000.

The 50,000 sq. ft., one-story, frame, metal-clad, unsprinklered Chillicothe Warehouse Co. cotton storage building without lightning rod protection was a total loss. The fire is believed to have been caused by lightning at 5:30 A.M. Approximately 2700 bales of cotton were destroyed by the flames, although the fire department was able to save about 3800 bales stored in the open yard at distances of 75 to 100 ft. from the burning building. They were aided in this by a heavy rainfall which started about 45 minutes before discovery of the fire and continued until 10:00 A.M. Forty-mile winds, however, scattered burning brands and sparks across the yard, requiring prompt application of hose streams in numerous instances. The fire was discovered by the watchman on duty, who attempted to check the blaze by water cask and pail, but was unsuccessful and subsequently called the local fire department.

June 18, Biola, Calif. Warehouse. $1,341,631.

Sheds and a warehouse of the Sun Maid Raisin Growers Association were used for the storage of dates, raisins and some $500,000 of Navy materials. This large concentration of values subject to a single fire had no fire protection. Fire from either a burning rubbish pile or an unattended grass fire ignited frame sheds, and spread through ordinary windows to a 14,000 sq. ft., two-story warehouse of fire-resistive construction (except roof). High winds increased the intensity of the fire. There was no municipal fire department, but California State forest fire forces, 14 miles away, responded to an alarm given by a neighbor. There was no hydrant system and only a little water in an irrigation ditch. The fire burned for two days and left only the brick walls of the warehouse.

June 25, Denver, Colo. Army Warehouses. $300,000.

Three warehouse buildings of wood-frame construction, each 200 x 50 feet, were damaged by fire at the Rocky Mountain Arsenal as high winds threatened to spread the flames to the main incendiary bomb loading plant. Discovered at 6:00 P.M., Army and Denver fire fighters manned fourteen pieces of fire equipment to bring the blaze under control within an hour and a half. The buildings were used for reconditioning equipment as well as storage, but the fire started during non-operating hours and the cause has not been officially announced. Several freight cars were also badly damaged.

July 22, Lafayette, La. Ice Plant and Cold Storage. $308,422.

The Louisiana Public Utilities building, occupied as an ice plant and cold storage warehouse, was totally destroyed as flames spread throughout the one-story, 35,000 sq. ft. structure. Discovered at 7:22 A.M. Sunday by an employee coming to work, the engine room was heavily involved, and the telephone report was interrupted by the threatening advance of flames. Fire department work was severely hampered by lack of water supply, as the nearest hydrant on a 4-in., dead-end main was rendered useless when connection was made to a second hydrant, 600 ft. away, on a 6-in. main. The metal-clad and wood walls, the flat deck wood roof, the absence of automatic sprinklers or an alarm system and the lack of masonry subdivision walls, plus adverse winds, contributed to the total loss. Contents valued at $287,572 included furs and other clothing in storage for four cleaning and laundry companies in the city.

July 27, Cheriton, Va. Warehouse and Cold Storage Plant. $1,000,000.

Lightning is blamed for the destruction by fire of the more than two acre F. L. Webster Company frame warehouse and an adjoining frame cold storage plant. The unsprinklered plant was without lightning protection. Discovered by a trucker at 10:00 P.M., response was made by the Cape Charles Fire Department and by companies from three other communities. The main food processing plant fortunately was saved by the efforts of the fire crews. Although openings were protected by substandard doors, a brick wall between the gutted warehouse and the main building was effectively used by fire fighters. The greatest portion of the loss was in stored canned goods. This company is one of the largest packers and canners of fruits and vegetables in the East.

July 30, Port Allegany, Pa. Extract Warehouse. $250,000.

Fire, set by a 13-year-old boy, destroyed a 10,000 sq. ft. open frame shed, without sprinkler or watchman protection, owned by the American Extract Company. Closely tiered stocks of wattle bark in bales, bags of tara pods, quebracho and myrabolam nuts, paper bags of prepared extracts and barrels of borax caused an unusually high contents loss, whereas the building was valued at only $10,000. First noticed at 7:30 P.M. by the crew of a passing freight train, the alarm was delayed sufficiently that the flames involved the entire shed. The volunteer fire department was forced to concentrate on preventing spread to more important, sprinklered buildings, with standard watchman service, only 20 to 30 ft. distant, which were seriously exposed. Despite a limited water supply, their efforts were successful over a two-hour period.

Aug. 17, Depot Harbor, Canada. Wool and Cordite Warehouse. $3,000,000.

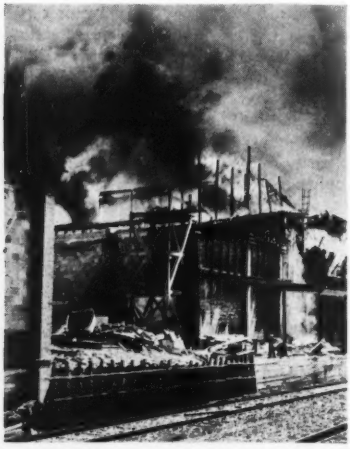
An exposure fire of major proportions caused exceedingly heavy fire losses when sparks ignited two wood warehouses, one containing large quantities of wool and the other huge stocks of cordite. Full information is not yet available, but known facts indicate that a grain elevator, in process of being dismantled, caught fire from an unknown cause at about 9:30 P.M. A high wind showered sparks over a distance of 800 feet (across a harbor) to ignite the two totally unprotected properties for which no defense could be mustered. Canadian authorities are investigating the loss.

Aug. 18, Arbuckle, Calif. Grain Warehouse. $450,000.

The main grain warehouse of the J. C. Hornall and Co. plant was destroyed by fire when gasoline fumes were ignited by an acetylene torch. A gasoline truck was dumping gas into a drum inside the building when another workman lighted the torch and the resultant flames spread explosively in the dust-permeated plant. The building, 60,000 sq. ft. in area, with wood and corrugated iron walls and roof and a concrete floor, was one story high. Nearby were five concrete, bulk grain storage bins 60 ft. high, plus working legs and houses holding bulk storage equipment. The volunteer fire department responding to the 1:30 P.M. alarm (temperature 104°) concentrated their efforts successfully on saving the five bulk storage bins, the acre-and-a-half, undivided warehouse being totally involved so that practical fire fighting was impossible despite the prompt transmission of alarm. Five other volunteer departments aided in the work. Reignition of burned grain occurred twice after the main fire was extinguished.

Aug. 22, near Sacramento, Calif. Cold Storage Plant. $313,000.

This is another case where sparks from an acetylene torch were allowed to ignite flammable materials (in this instance, cork and insulating paper in an unfinished wall). The property involved was the cold storage section of the Bercut-Richards Packing Company. It was under construction, located outside the city limits of Sacramento. The flames caused four explosions of three 2000-pound tanks of ammonia and a tank of acetylene gas, injuring four workmen, one seriously. The unfinished building, 600 x 100 ft., lacked a roof, but possessed brick and concrete walls. A large refrigeration unit had been installed on a concrete platform, boarded up on all sides, near the roof line. Hose lines were placed in operation behind a protecting fire wall which fortunately divided the cold storage section from the balance of the warehouse. This action was effective in preventing the spread of fire and its final extinguishment. The management was fire conscious, had paid the city of Sacramento for fire protection and had installed two high pressure pumps to boost the water supply. An Army Signal Corps pumper and crew aided in fighting the fire.



Sacramento Union.

Sparks from an acetylene torch ignited construction materials at this brick and concrete warehouse at Sacramento, Calif., on Aug. 22. Buildings in course of construction often present a far greater hazard than after completion.

Sept. 12, Lake Wales, Fla. Food Warehouse. $750,000.

A large storage and cooler plant (government owned and operated by the Florida Citrus Canners Cooperative) was completely destroyed by fire and dealt the state its second large citrus industry loss within a month. (See fire of August 27th, Dunedin, Fla.) Apparently caused by lightning, the flames started among empty pasteboard boxes and cartons about 7:15 P.M. and burned for approximately thirty minutes before discovery by a neighbor. The unsprinklered building was of concrete block construction, with asphalt and slag roofing, without lightning rod protection. The solid walls were 18 ft. high at eaves, forcing the fire fighters to direct water streams from four nozzles over the top of the walls to reach the burning contents. Four engine companies were available after calls were made to Winter Haven and Bartow. The bulk of items stored was fruit juices and concentrates for lend-lease and military use, valued at $675,000 by the president of the Canners Cooperative.

Sept. 13, Seguin, Texas. Cotton Compress. $500,000.

Fire of unknown origin consumed the Seguin Compress Company plant while no one was in the plant, destroying some 3500 bales of stored cotton. A night watchman completed his last round at 5:45 A.M. and went home, placing the clock in the office. In leaving the property, no one relieved him. The fireman did not arrive at 4:30 A.M., his usual time, as the boiler had

been condemned and repair parts were not available. Flames were first seen by a workman going to a near-by plant, and he telephoned the Fire Department at 6:05. On arrival, the fire was spreading very rapidly from the proximity of the boiler house section, and the entire unsprinklered building was so involved that it was useless to save anything except exposed properties. No check could be made upon the statements of the watchman that he had completed his scheduled rounds, as the dials and clock, as well as all other records of the company, were destroyed by fire.

Sept. 22, Fontana Dam, N. C. Building Equipment Warehouse. $250,000.

High valued contents (approximately $242-500) in a frame, metal covered, unsprinklered warehouse, 60 x 250 ft., accounted for another large loss as flames from a closely adjacent office spread to the building. The Tennessee Valley Authority property was classed as "temporary," but at the time of the fire was heavily stocked because the contents of another warehouse, being torn down, had been added. Delayed reporting of the 11 P.M. fire, plus weak water supplies, prevented effective fire suppression by the T.V.A. Public Safety Service firemen. A gravity tank, normally available, had been cut off by the Water Department without notification to the fire crews, and as a result the six hose streams used were below standard. Four fire fighters were injured in the operations. An inquiry into cause is in progress, with some suspicion that the fire was "set" by an employee to prove his argument with another worker that a box of rags constituted a fire hazard. Included in the contents destroyed was a drum of kerosene, oxygen and acetylene tanks (which exploded), tires, paints, tools, office supplies and engineers' equipment.

Sept. 28, Lafayette, Ind. General Warehouse. $330,000.

The two-story brick and frame Ardapple Warehouse was destroyed by fire as absence of automatic protection, watchman service and fire cut-offs permitted flames to reach through the roof before discovery. Reported at 9:00 P.M. by an unidentified woman, the highly valuable contents, consisting of household furniture, seed corn, oil, sugar, newsprint and miscellaneous general storage, were fanned by strong winds into a roaring inferno even as fire equipment responded. Four engine companies used seven hose lines in efforts to extinguish the fire, but could not bring it under control until midnight. From all evidence, the blaze started in the center rear section of the first floor and spread vertically through an unprotected elevator shaft in the center of the large building. Cause is listed as unknown, with the possibility of either spontaneous ignition or a cigarette.

Oct. 19, Greenville, S. C. Cotton Warehouse. $750,000.

A short circuit in an extension cord of a loading and tiering machine is blamed for starting a fire in the North Georgia Warehouse Company plant, resulting in the total destruction of the 300-ft., unsprinklered warehouse. Discovered by a woman sweeper, the fire spread so rapidly that despite prompt alarm to the city and efforts of employees to extinguish the blaze with inside hose lines, little could be done to save the large supply of baled cotton. Greenville fire fighters, aided by two volunteer departments, placed eight hose lines in use from a good water supply. The warehouse was one-story high, with sheet metal siding and composition roof. Exposed frame dwellings were saved. Heaviest portion of the loss was to cotton, and delay in notifying salvage authorities aggravated the extent of damage.

Oct. 25, Altus, Okla. Cotton Compress. $395,000.

Fire, undoubtedly caused by a fire-packed bale fresh from the cotton gin, caused a loss of 4700 bales of cotton in one section of the Traders Compress Company warehouse. A watchman detected the odor of burning cotton as early as 7:45 P.M., but after considerable search could not find the hot bale. He failed to notify the superintendent, as instructed, believing it to be an odor retained from an earlier fire that afternoon in the same compartment, which had been extinguished. When the watch changed shifts at 12:30 A.M. the new men were advised of the suspicious odor, but flames were not discovered until the 1:45 A.M. tour. Fire then flashed rapidly as the watchman returned to the office a quarter of a mile away to turn in the alarm at 1:51 A.M. When firemen arrived the entire section, 200 x 400 ft., was involved, with only the fire walls of reinforced concrete successfully preventing spread to the other three similar sections on each side. Absence of automatic sprinkler protection required the use of five hose lines, and the fire department remained on duty until 6:00 P.M., when the Underwriters Salvage Company took over. The warehouse, except for fire walls, was ordinary frame, open-joisted construction and has been the scene of five fires since 1924, each one of major consequence, causing an average of over 1000 bales lost annually over the twenty-year period.

Fifty-year-old tobacco warehouse burning in Winston-Salem, N. C., November 6.

Oct. 28, Forty Fort, Pa. Warehouse and Garage. $275,000.

Huge stocks of automobile and truck parts owned by the General Motors Corporation, and motor freight and equipment owned by the Karns Transfer Company were destroyed by a general alarm fire which razed the Matheson building. The one-story structure was divided into two sections by a poured concrete wall which was not parapeted. Exterior walls were also poured concrete, with a continuous wood roof over the entire building, which was approximately one acre in area. The fire started when a mechanic in the garage section, working beneath a truck, ignited his coat sleeve with a match. He removed the coat and threw it on the garage floor where there was spillage of gasoline from an inside gasoline fuel pump. The fire rapidly spread to the wood roof. Fire fighters from the Forty Fort department responded promptly to a telephone alarm and were later aided by firemen from Luzerne, Edwardsville and Kingston. Inadequate water supplies due to the spacing of hydrants too far apart hampered the firemen in their attempts to extinguish the fire. In addition to the loss of the building and automobile parts, three trailer trucks with mixed loads of silk, rayon, general merchandise, teletypewriters and teleprinters were lost. Eighty-five drums of anti-freeze were stored in the garage section of the building, but none exploded and seventy-one were not damaged.

Nov. 6, Winston-Salem, N. C. Tobacco Warehouse. $300,000.

The fifty-year-old brick Gorrell Warehouse was destroyed by an early morning fire estimated to have consumed a million pounds of leaf tobacco owned by the Commodity Credit Corporation and Taylor Brothers. Reported at 2:18 A.M. by box and telephone, no cause could be assigned, as flames were through the roof by the time equipment reached the scene. The entire city fire-fighting force was largely concentrated on preventing the flames from destroying the Piedmont Warehouse, a garage and a dwelling, all seriously exposed. An indirect loss was occasioned by the cutting of electric power, which caused 6000 baby chicks to suffocate in a near-by hatchery. The warehouse was under lease to the Victory Storage Company, a government-owned company.

Nov. 8, Cleveland, Ohio. Battery Storage. $300,000.

Sparks, believed to have come from a burning rubbish pile, ignited waterproofed paper which covered closely packed piles of special, large size rubber and aluminum battery cases stored about three feet from Warehouse L of the Willard Storage Battery Company. Fire, fanned by a 22 m.p.h. wind, quickly spread and communicated to the building through plain glass, steel frame windows. Plant fire brigade forces were on the scene quickly, but the outside storage surrounded the warehouse along three sides in piles 10 feet high (estimated 75,000 cases), and the heat, flames, and greasy black smoke advanced unchecked until the piles could be torn down to allow water streams to reach the inside of the rubber battery cases stored bottom-side up. Response by the city was made on an 11:17 A.M. alarm and massed nine engine and three ladder companies so that twelve public and six private hose streams were in use. The one-story, unsprinklered warehouse building had concrete block walls with wooden roof on unprotected steel supports. Damage was considerable, four bays of the roof fell in, steel members warped, one corner of the building collapsed and the roof covering burned off, interrupting peacetime production. The outside storage of battery cases was necessitated by reconversion space problems, government contracts having been canceled.

Nov. 10, Fairfield, Calif. Army Warehouse. $1,000,000.

A large, frame warehouse, storing parts and equipment for C-54 "Skymasters" and LB-30 "Corsairways," was destroyed by an early morning fire at the Fairfield-Suisun Army Air Base. Official reports of the loss have not been released, but newspaper accounts indicate that delayed discovery made hopeless the saving of any part of the unsprinklered building. When Base fire fighters reached the scene, flames were through the roof and the quick-burning contents rapidly spread the fire. Several adjoining buildings, some catching fire from the exposure almost immediately, were saved by the firemen. Previous losses at the Base, operating three years, were claimed to have been less than $1000.

Dec. 23, Mullins, S. C. Warehouse — Circus Equipment. $250,000.

The block-size Clark Warehouse No. 2 was totally destroyed by a night fire which resulted in the loss of all the equipment of the James E. Strates Circus stored there for the winter. Six Diesel electric plants, four ferris wheels, merry-go-rounds, caterpillars, whips, kiddie rides and scores of show wagons, tractors, trucks, big-tops, and tents were lost, as well as small animals and fancy birds. Show employees, also living in the warehouse, barely escaped with their lives as the fire spread throughout the building with great speed. Exploding tanks of gasoline in the trucks added to the fire as Mullins and Marion Fire Departments battled the blaze for several hours and saved adjoining buildings. Newspaper estimates of the loss vary from $250,000 to $500,000.

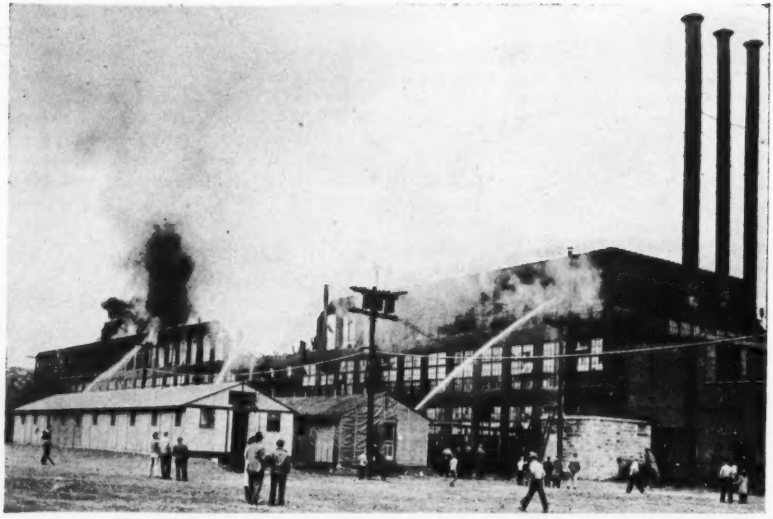
Dec. 19, Hobart, Okla. Cotton Compress. $500,000.

A daybreak fire of undetermined origin wiped out one section of the Traders Compress before fire fighters could bring it under control. Newspaper accounts indicate that 4700 bales of cotton, plus plant machinery, were lost, but that an equal amount of cotton was saved by the protection afforded by a fire wall.

Chemical Plants.

Jan. 7, West Haven, Conn. Chemical and Experimental Heat Treating Plant. $266,000.

The one-story brick wall, wood roof, A. F. Holden Co. chemical plant was totally destroyed by a fire reported at 3:04 A.M. by the plant watchman, unfamiliar with printed instructions regarding the hazards involved in the plant operations, who discovered the contents of a nitriding furnace boiling over on the floor of the plant. The watchman called a friend familiar with the furnace operation before calling the fire department. It is believed that the temperature control failed to function and the overflowing salt solution of the furnace came in contact with a wooden screened door of the plant chemical laboratory and plywood partition, which ignited. The heat from this fire caused the ammonia tank supplying the nitriding furnace to explode. A delay of approximately half an hour occurred before the watchman summoned the fire department, during which time he attempted to find out how to control the overflow and extinguish the fire. One other employee was working in the plant making tempering compound for shipment to brass plants. As flames heated a carload of



Bright Star Battery plant, Clifton, N. J., May 13. Gravity tank practically empty; sprinkler system without sufficient water. Loss $400,000.

finished compound in a shed, explosions occurred when hose streams were applied. A number of violent explosions of drums of nitrates stored in the open throughout the shop accompanied the fire, breaking numerous windows in the vicinity. Ten tons of nitrates in paper bags stored in a fire-resistive storage room were unharmed when a fire door operated automatically. The plant was engaged in experimental work on heat treatment of rocket shells on war contract in addition to manufacture of tempering compound. Outside fire departments were called in to assist in battling the blaze and to prevent fire from spreading to adjacent residential buildings. In a similar accident prior to this fire, the same nitriding furnace had overflowed and the spilled chemical was smothered with sawdust by an employee and no fire ensued.

May 13, Clifton, N. J. Battery Manufacturing. $400,000.

A practically empty 40,000-gallon elevated water tank supplying the automatic sprinkler system has been blamed for the disastrous extent of this fire, which broke out about 6:00 A.M. Sunday in the Bright Star Battery (dry-cell) plant. Only the existence of a 1000 g.p.m. fire pump taking suction from a 146,000-gallon reservoir under the main building is credited with saving the plant from total destruction. From all appearances, the fire, exact origin unknown, started under assembly tables in the center of the third story of the brick, plank-on-steel constructed building. The fire damaged approximately 20,000 sq. ft. of the upper story and roof of the main building and was communicated to the tamping building and by radiation to adjoining building No. 2, 50 feet detached. Stock and machinery on other floors were considerably damaged by water. The plant night watchman, making sub-standard rounds, had gone off-duty. The day fireman noticed smoke about 6:27, pulled a manual fire alarm box in the boiler room and immediately started the fire pump. The Clifton and Paterson Fire Departments responded immediately, placing seven hose lines in operation. The sprinkler system had been inspected by the insurance carrier on April 18th and was found to be in good working order. The owner failed, however, to report or investigate leaks in the 18 ft. water tank which, by actual tests, was found to lose 2½ ft. in two hours when the check valve clapper hung open due to wear on the clapper pin. It is assumed that this difficulty was the basic reason for the empty elevated tank which had been filled (according to testimony) at 7:00 P.M. the previous night.

Metalworkers.

Jan. 1, Sorel, Que. Metalworker. $1,000,000.

This shell stamping and filling plant, owned by the Dominion Government, operated by the Sorel Industries, Ltd., was manufacturing shells for the U. S. Government. The department involved consisted of an unsprinklered, combustible, roofed-over space, 60 ft. wide, 800 ft. long and 35 ft. high high, located between two, unsprinklered fire-resistive plant buildings. About 11:20 P.M., shortly after reopening of the plant following a 24-hour New Year's holiday, hot shells were being lowered into a tempering tank of allegedly non-flammable oil in which completed shells were dipped. Before these shells reached the oil there was a violent explosion and a fire occurred, immediately involving the wood roof 35 ft. above the tank. Fire-resistive walls in the adjoining buildings aided the local and plant fire brigades in preventing the extension of the fire to the adjoining structures, though the wood roof section and shell filling plant were completely destroyed.

Jan. 18, No. Hoosick, N. Y. Metalworker. $500,000.

This plant, occupied by the White Flomatic Corp., making artillery ammunition boosters, was completely destroyed in a fire started by careless smoking on the part of a nightshift employee in the automatic screw machine department. The employee lighted a cigar with a wooden, strike-anywhere match and threw the match on the floor, where a fairly large accumulation of oil ignited. Flames enveloped the entire machine room so quickly that employees were unable to reach their coats before escaping. The plant was without sprinkler equipment, and there was no first-aid equipment of any kind on the premises. The plant was located outside of a fire protection district, but three pieces of equipment were finally summoned from Hoosick Falls and Bennington, Vt. Firemen were able to save the brick and frame office and a fire-resistive building being used as a foundry.

Feb. 9, Chicago, Ill. Vierling Steel Works. Metalworker. $264,000.

This 2½-acre plant, including machine shop, paint shop, storage for patterns, etc., was manufacturing steel pontoon bridge curbs for the United States Navy. Fire, originating in the paint dipping department on the first floor of the three-story section of a one and three-story brick-joisted building without automatic sprinkler protection, destroyed a ground area of 15,000 sq. ft. Work performed in this section consisted of assembly, welding, drilling, grinding, painting and packaging of steel pontoon bridge curbs. Due to wartime speed-up, degreasing and painting processes, formerly carried on elsewhere, had been brought into this former metalworking area. This equipment included open-flame degreasing tanks and paint, priming and finishing dip tank, and presented hazards which were new and unrecognized by the firm. The liquid used for degreasing was dichloroethylene. The priming and finishing paint was U. S. Navy Specification, thinned by the application of naphtha which had replaced mineral spirits to speed the drying process. Paint was reportedly kept agitated by application of air pressure. Dip tanks were adjacent to the open flame degreasing unit, there were portable grinders and a near-by coal stove, and employees were permitted to smoke, so that the exact source of ignition could not be determined. Employees discovered fire at approximately 4:00 A.M. and fought the flames in a 200-gal. dip tank with hand foam extinguishers. Failing to extinguish the fire, they closed several rolling steel doors and telephoned an alarm to the fire department, but before its arrival the first and second floors of the section were involved. The plant watchman who was first detailed to call the fire department became confused and failed to call. He later died in the flames. A second employee was also trapped on the second floor and lost his life. More than 15 minutes delay is believed to have occurred before the first alarm was given. This alarm, followed by five subsequent alarms and two special calls, brought a total of 48 fire companies. Radiated heat was so intense that it severely damaged several pieces of fire apparatus and destroyed many lengths of charged fire hose.

Feb. 9, Beatrice, Neb. Beatrice Steel Tank Mfg. Co. $500,000.

This large, unsprinklered plant, 26,000 square ft. in area, consisted of one-story buildings of frame, ironclad and brick-joisted construction, with openings unprotected by fire doors. The plant was making metal powder containers for the U. S. Navy. Fire was first noticed at 4:30 P.M. in the ventilating stack of a spray booth in a paint spraying room which was formerly an oil room. Ventilating facilities for the unsprinklered, approved type spray booths were inadequate for the room in which the conveyor-type driers on which parts finished in Navy Specification aluminum paint

Two men were killed and damage of $264,000 was caused on Feb. 9, when fire destroyed this Chicago steel plant engaged in war work. Due to wartime speed-up, open flame degreasing operations, formerly carried on elsewhere, had been brought into an area with dip tanks. To speed drying, naphtha was substituted for higher flashpoint solvents in the paint.

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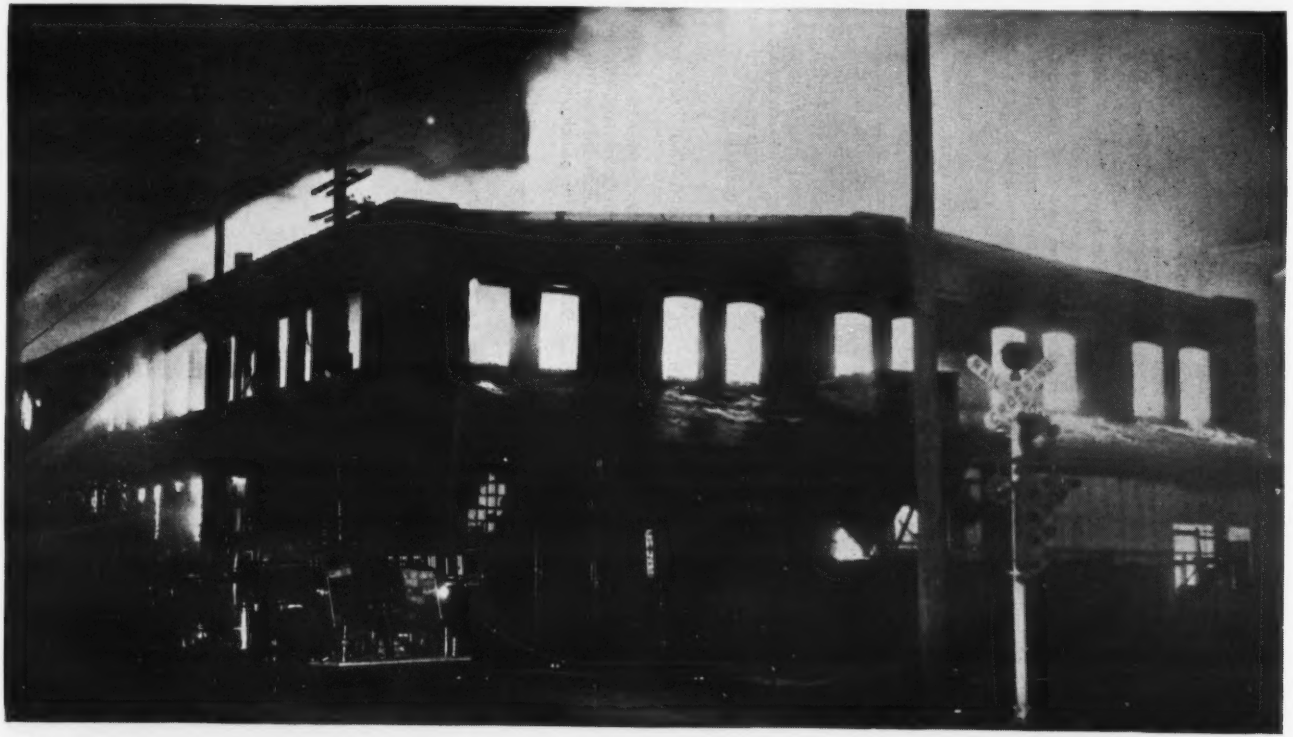


Acme.

Employees were unable to reach a manual control valve on a carbon dioxide extinguishing system for a large oil-quenching tank in this fire on February 15, at a Chattanooga, Tenn., war plant manufacturing ammunition. Two men were killed as a result of this fire.

(containing 70 per cent thinner or naphtha) were being dried. The only near-by hydrant with adequate capacity, installed for pumper use six months previously, had been out of service for several days. The relatively weak hose streams furnished by the several long lines of hose which firemen laid were unequal to the task of limiting the spread of flames.

Feb. 15, Chattanooga, Tenn. Columbian Iron Works. $293,000.

The unsprinklered building in which fire occurred was a two-story, part basement, semi-mill brick structure with concrete first floor, open and enclosed stairs and an open elevator, occupied by a machine shop for finishing steel shell forgings and minor lacquer spray painting operations. The fire, of undetermined origin, was discovered by an employee near the first floor gas-fired degreasing machines using trichloroethylene solvent, and reported by telephone at 7:08 P.M. Employees attempted to extinguish the fire with hand extinguishers and standpipe hose, but were driven from the building. The fire spread rapidly to a 9000-gallon open oil quenching tank on the first floor. The tank had a manually-controlled carbon dioxide extinguishing system, but the valve was inaccessible to employees due to the heat. At the time of arrival of the fire department the fire had spread rapidly to the second floor through the open elevator shaft and well hole, involving drums of lacquer, machine oil and quenching oil. Second and third alarms were transmitted by radio at 7:12 P.M. and a fourth at 7:35 P.M. About 100 employees of the plant's second shift were in the building and the majority left it without difficulty. Two employees trapped on the second floor were forced to jump, and sustained only slight injury. One employee was found dead on the second floor after the fire. Exploding oil drums on the second floor scattered burning oil and were a factor in the rapid spread of fire throughout the building. A brick joisted office and warehouse building, 12 feet detached, was saved by firemen, aided by a good brick-parapeted fire wall with wired-glass windows in the exposing wall.

Feb. 17, Minneapolis, Minn. Automatic Screw Machine Metalworker. $372,153.

The Griswold Signal Co. and N. W. Automatic Products Co. manufactured and repaired electric traffic signals and lubricating equipment. It occupied a one-story unsprinklered building with brick, tile and cinder block walls, and wood-joisted roof on unprotected steel beams. Thirty-two high speed automatic screw machines were in operation, each with 25 gallons to 150 gallons cutting oil capacity. The shop was highly congested, with narrow aisles and additional equipment, drills, lathes and grinders, drums of oil, and raw stock. Sawdust was used to absorb spilled oil. The fire, reported by telephone at 3:12 A.M., started in oil-soaked sawdust due to careless smoking. Attempts to enforce "no smoking" rules were particularly unsuccessful on the night shift. An employee made an unsuccessful attempt to put the fire out with carbon tetrachloride fire extinguisher, but flames spread rapidly to the ceiling, where heated oil vapors resulted in almost flash fire conditions. Due to zero weather outside, all roof ventilation openings were closed and considerable heat and oily smoke from high speed automatic screw machines had saturated the air and structure with an oily film. When the first firemen arrived, the building was heavily involved, and fire was not extinguished until entire roof collapsed and the building and contents were a near total loss. Firemen were successful in preventing serious damage to adjoining buildings, even though parapeted party walls had unprotected openings.

Feb. 21, Indianapolis, Ind. Metalworker. $249,201.

Fire, origin unknown, reported at 1:28 P.M. by a central station fire alarm signal from the Peerless Furnace Co., extended over the entire second floor of this unsprinklered two-story

The Pennsylvania Range Boiler Co., Philadelphia, on April 13. Inadequate water supplies hampered fire fighting.

brick-joisted structure, and later spread to the first floor. Strong winds fanned the fire through the 300 ft. long structure, containing offices, machine shop, sheet metal shop, steel furnace shop, assembly and warehouse for bilge pumps and furnace parts. Firemen used 13 large and 6 small hose lines to confine damage to the building of origin. A foundry of hollow concrete block construction on the property was saved as well as an industrial plant and dwellings across a street.

April 6, Syracuse, N. Y. Metalworker. $976,888.

Laxity in the maintenance of automatic sprinkler protection resulted in the total destruction of the E. C. Stearns & Company's 75-year-old hardware specialty plant from a fire of unknown cause. Originating in the shipping and packing room at 5:30 A.M., and discovered by a watchman on duty, city response was immediate, but a general alarm failed to suffice, as the flames ripped through the 4-story, brick-veneered, plank and timber factory. The fire spread rapidly to adjoining and communicating buildings, and the east wall of the main plant was blown out by a mild explosion, injuring seven firemen, two seriously. Four suburban fire companies aided the city force of 100 men, bringing 25 hose streams into action from a constantly sufficient underground water supply system. Investigation after the fire revealed that the dry pipe system on the first floor (where the fire originated) was shut off, and the wet pipe systems on the upper stories of the southerly sections of the main building were also completely closed. The valve to the northerly upper sections of the building was found less than half-open while a 30 lb. lead obstruction was lodged in a riser tee. Non-operation of the dry pipe sprinkler system negated the value of the sprinkler alarm. The fire was reported by public street alarm and telephone simultaneously, but was well advanced by the time of fire department response.

April 13, Philadelphia, Pa. Metalworking. $270,000.

The boiler shop section of the Pennsylvania Range Boiler Co. was destroyed by fire caused by the backfire of an oxyacetylene cutting torch. Flaming hose lines, blown from the torch but still attached to the acetylene and oxygen cylinders, fell against a wooden storage bin and started an immediate fire among combustible materials in the vicinity. Most of the employees, including the welder's helper, were at lunch and first observed the flames through an open door. The alarm was promptly telephoned to the city department, but the fire quickly involved the light plank roof, and efforts to extinguish the blaze with hand extinguishers were ineffectual. The section involved was a high, single-story building, having part stucco-faced brick walls with upper portion steel framed,

Columbus, O., Fire Dept.

The Blaw Knox plant; Columbus, Ohio, after the fire of May 6, 1945. Roof has collapsed over the paint spraying area. Fire started about 100 feet to the right of this scene. Note the pile of Navy anchor chain links in the foreground.

Syracuse Herald-Journal.

Closed sprinkler valves and an obstructed pipe contributed to this $976,888 fire loss in a Syracuse, N. Y., foundry on April 6, 1945. Only through frequent inspection and conscientious maintenance can the effectiveness of fire protection equipment be assured.

Closed sprinkler valves and an obstructed pipe contributed to this $976,888 fire loss in a Syracuse, N. Y., foundry on April 6, 1945. Only through frequent inspection and conscientious maintenance can the effectiveness of fire protection equipment be assured.

Shreveport, La., May 4. Loss $292,500. Paraffin-impregnated paper bomb bands, piled outside the building, ignited by spark from welder's torch. Sign reads, "The entire facilities of this new plant now going to Uncle Sam."

Factory Insurance Assn.

Part of the ruins of Briggs Manufacturing Co. building, Detroit, after $300,000 fire of June 25. Designed for non-combustible storage, but converted for war manufacturing, the unprotected steel collapsed due to the heat of burning contents.

part wood, iron clad between sections of plain and wired glass windows in steel sash. It formed one part of six moderately sized, adjacent and communicating buildings, forming five fire divisions, without automatic sprinkler protection. Fire fighting was immediately hampered by old, weak and corroded six-inch mains, which prevented the use of effective hose streams until approximately 45 minutes after pumpers were on hand. Eventual manipulation of equalizing valves on the city mains, reducing consumption in the neighborhood, and the use of smaller nozzle tips brought the fire under control at 2:00 P.M. The plant was producing heating equipment under government contract.

May 4, Shreveport, La. Bomb Casing Plant. $292,500.

An extremely hot fire resulted at 11:25 A.M. when a contractor's workman, using a welder's torch, ignited a totally unprotected pile 30 x 200 x 5 ft. of paraffin impregnated paper bands on which the welder was standing while cutting holes in a structural steel column. The work was being done in preparation for the construction of an addition to the Brewster Company's bomb casing plant. The building involved was 56,000 square feet in area, one-story (44 ft. at peak and 16½ ft. at eaves), irregular in shape with protected metal siding and roofing on metal rafters, trusses and supports. Within minutes the terrific heat and flames from the melting paraffin raised the temperature to a point which caused extremely rapid combustion of the vaporized asphalt binding and coating on the protected metal which, accordingly, spread the fire throughout the building. Wired glass windows melted completely, structural steel framework in the vicinity of the paper bands warped and buckled and an entire steel railroad box car collapsed when the fire spread to its partially loaded contents. The paraffin-impregnated paper bands had been substituted for steel by Government order and were used to protect the bomb casings during movement and shipment. The fire department was severely hampered by low water pressure, high winds, cyclone-type fan ventilators in the building, a broken hydrant, and the long hose lines required. While failure to protect highly combustible stocks against ignition by welding sparks was the direct cause for this war plant loss, the existence of such a large stock of impregnated paper bands was an invitation to a serious fire, regardless of source.

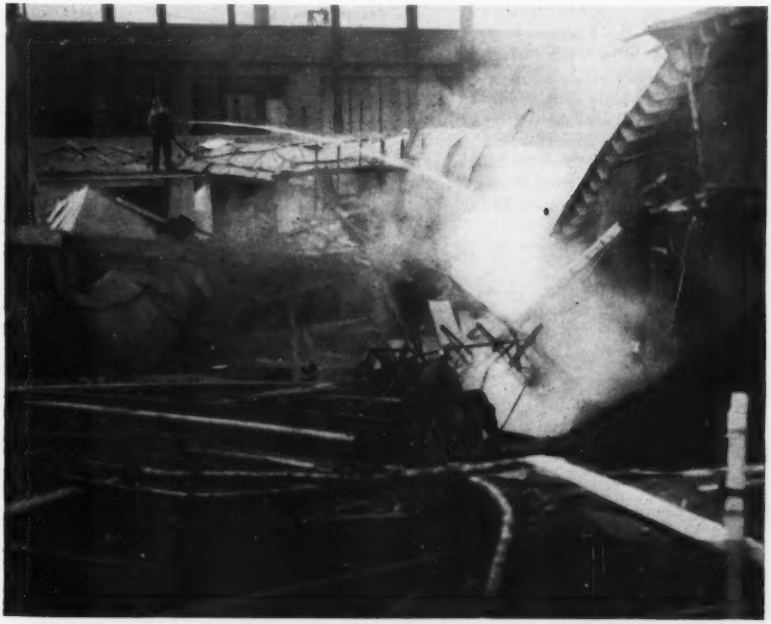
May 6, Columbus, Ohio. Heavy Metalworker. $1,750,000.

Sawdust and wood shavings employed to absorb a solvent (flash point 105° F.) used in the cleaning of metal tubes, ignited when a lighted match dropped to the floor as an employee lit a cigarette. The plant (Blaw Knox

Company) was producing rocket bomb casings and anchor chains for the Navy and was in partial operation on this Sunday afternoon at 4:30 P.M. The fire spread along the floor, and employees delayed sending the alarm to the fire department three miles distant while making attempts to stamp out the fire and use hand extinguishers. The fire quickly raged out of control as the asphalt-covered metal roofing ignited, and flames spread throughout the 52,000 sq. ft. one-story, steel-frame, brick-walled, unsprinklered plant built in 1916. Eleven hose lines were used in the attempt to extinguish the fire, but control was not established until three hours later after parts of the roof structure collapsed and the building was 80 per cent lost. Contents were severely damaged by burning asphalt dripping from the roof and igniting oil coating on parts, packing containers, wooden platforms and other combustible materials. Promiscuous smoking at machines throughout such a plant is a highly hazardous risk. Fortunately 60 employees escaped without injury. (For further details see July, 1945, QUARTERLY, page 68.)

June 25, Detroit, Mich. Manufacturing Airplane Parts. $300,000.

Careless disposal of a lighted cigarette in a shredded paper bin spread fire quickly throughout the Mack Avenue plant of the Briggs Manufacturing Company, causing heavy damage to both building and contents. Originally used for salvaging of metal parts and storage of incombustible materials, sprinklers were not installed in this 732 ft. x 55 ft., one-story, asphalt-asbestos-coated metal structure. War conditions, however, introduced considerable salvage storage, paper baling and shredding, which subjected the plant to greater hazards, with no improvement in protection afforded. The heat resulting from the quickly spreading fire flowed along the underside of the roof, melted the asphalt impregnated asbestos covering, which peeled off when ignited and dropped on combustible contents, spreading the fire disastrously. Sprinklers stopped the spread of fire to other protected portions of the plant when flames traveled across enclosed passageways. Fourteen hose streams from 12 pumpers fought the fire for five hours.



An explosion of a nitrate bath in heat treating department of the Iron Fireman Mfg. Co., Portland, Ore., August 23, killed two employees and injured sixteen others. The explosion and ensuing fire were caused by overheating of nitrate bath in which 35 pounds of aluminum alloy castings were being treated. Loss $300,000.

July 27, Indianapolis, Ind. Metalworker. $555,000.

The use of a series of contiguous frame, lightly constructed buildings (not protected by automatic sprinklers) housing important, valuable and hazardous manufacturing operations, resulted in this large loss fire. The plant of the Climax Machinery and American Slicing Machine Companies was producing war material. Originating near an unused spray booth, the fire, of unknown origin, spread so quickly that despite the fact that city firemen arrived within one minute of the 1:02 A.M. alarm telephoned by the night engineer, flames were through the roof. Exploding drums of oil and paint in the yard added to the fire, which swept through nine buildings in one fire area, representing 52 per cent of the floor area of the plant, destroying raw and finished stock in storage, heavy machinery (including metal presses and screw machines) and the drafting and experimental departments. The only building saved was a sprinklered, ordinary brick-joisted, three-story building in the northeast corner of the 245 x 200 ft. city block. Fire fighters used 23 hose lines and protected the exposure across 10 ft. and 31 ft. alleys.

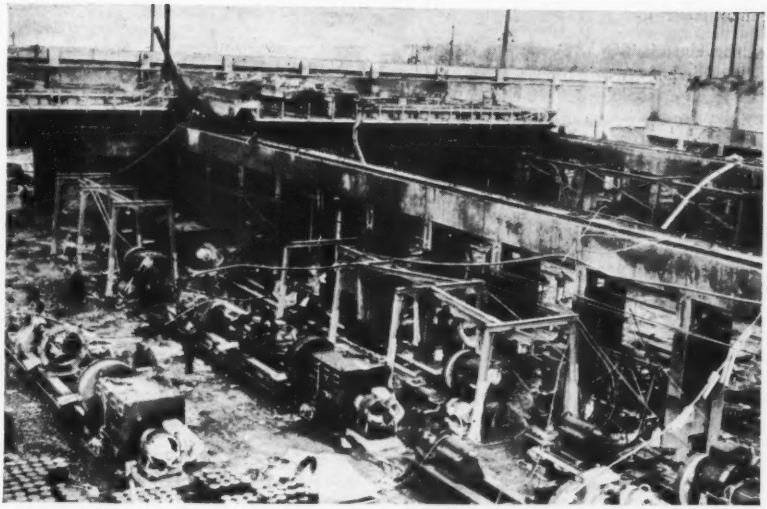
Aug. 23, Portland, Ore. Metalworker. $300,000.

The Iron Fireman Manufacturing Company Plant No. 1 was severely damaged by an explosion and fire which caused the death of two employees and injuries to sixteen others. The fire originated in a nitrate bath in the heat treating department being used to treat aluminum alloy castings and was apparently caused by overheating the salt solution. Occurring at 7:30 A.M., the explosion was of great force, demolishing the heat treating room (2900 sq. ft.), damaging three of six automatic sprinkler systems in the plant, weakening walls and partitions throughout the rest of the 1¾ acre building, starting a fire fed by oil and combustible ceiling construction and knocking down a wall which caused the deaths reported. City fire department response was immediate, but the fire appeared small at first and did not break out in serious proportions until 8:38. Control was made most difficult by the debris, which prevented getting water or foam on the seat of the fire. While the use of nitrate baths has been common practice, this explosion, coupled with two others in 1943 and 1945, has aroused much interest in this practice, especially for heat treatment of aluminum and magnesium alloys. (See QUARTERLY, October, 1945, pages 118-121.)

Sept. 20, Detroit, Mich. Machine Shop. $400,000.

Building No. 92 of the Packard Motor Car Company suffered a large fire loss when sparks from an acetylene torch ignited solvent-soaked sawdust on the floor. The fire occurred as plant employees were cleaning machines formerly used by the company on war contracts for removal by a contract firm. The cleaning was accomplished by spraying a petroleum spirit (with a flashpoint of 135° F.). As one machine was readied, the contractor cut a base plate bolt with a cutting torch to free it from the asphalt block on reinforced concrete flooring. Fire started when the sawdust was ignited and spread among the closely grouped machines

An unguarded welding operation started this fire in the Clyde Porcelain Steel Co. plant, Clyde, Ohio, November 11. Loss $790,000.



Part of the ruins of the Navy machine shop building, Bethlehem, Pa., after the fire of December 3. The wooden-roofed building was reported to be 1000 ft. long and 400 ft. wide, with neither fire walls nor automatic sprinkler protection.

over about half of the fifth story of the unsprinklered, fire-resistive building. Attempts by employees to kill the flames by using hand extinguishers and brooms only spread the fire, and thick smoke drove them from the building. One man was trapped and died from suffocation. Fire department response brought eight engine companies on the 11:27 A.M. alarm, and the fire was confined to the fifth floor by water streams, concrete construction and enclosed stair shafts. The large loss included heavy damage to approximately 250 machine tools on the floor, glass, exhaust and ventilating ductwork, electrical equipment and wiring and some spalling of concrete.

Nov. 11, Clyde, Ohio. Metalworker. $790,000.

An unguarded welding operation and dried-out wood plank flooring and roof set the stage for this large Sunday afternoon fire at the Clyde Porcelain Steel Corporation plant. Maintenance workmen were extending the conveyor system near one of five brick-set, gas-fired enameling kilns when the welder suddenly discovered the wood floor beneath him on fire. The dried-out plank flooring and roof in the vicinity, oil soaked from previous wartime operations, burned fiercely and prevented effective use of hand extinguishers. The local volunteer fire department, aided by four other communities, fought the flames, but despite all efforts little could be saved except the western portion of the plant (70,000 sq. ft.), which was protected by an effective eight-inch fire wall, with openings protected by standard, single, automatic-closing fire doors. The portion destroyed included one and two-story buildings, not subdivided, of approximately 100,000 sq. ft. (over two acres), with mixed brick and concrete block walls and a combination plank on steel truss (sawtooth type), plank on timber, and wood-joisted roof. No automatic sprinkler or alarm service was available, but ample hydrants on 10, 8, and 6-inch mains surrounded the plant on three sides.

Dec. 3, Bethlehem, Pa. Navy Dept. Metalworker. $2,000,000.

Fire, reported caused by a short circuit, destroyed a machine shop building owned by the U. S. Navy, with a loss estimated at over $2,000,000. During the war this building had been operated by the Bethlehem Steel Company for the manufacture of large shells, but was idle, under Navy supervision, at the time of the fire. The building had concrete walls but a wooden roof. No automatic sprinkler protection was provided and there were no fire walls to stop the spread of fire over the nine-acre, undivided, wooden-roof area. Characteristic of many fires in large area wartime structures, the most effective of manual fire fighting efforts were unable to prevent a total loss. It is fortunate that this fire did not occur during the war period.

Mercantile Group Fires.

Feb. 18, Chicoutimi, Que. Group Fire. $650,000.

Fire of unknown origin was discovered at 8:45 P.M. in a storage shed which later spread to and destroyed a group of buildings, comprising five mercantile grocery and furniture establishments and two apartment houses. Several sheds were also lost. The destroyed block was on the main commercial thoroughfare of the town.

May 11, Fort Kent, Me. Group Fire. $500,000.

Fire, believed to have been caused by defective electrical wiring, involved six closely built frame, wood-shingle roof, commercial buildings and then jumped 500 ft. across the street to two other wood-shingle roof structures before the volunteer department was in a position to check the flames. Originating in the parts room of a farm machinery repair shop, damage was severe to a filling station, tire vulcanizing, furniture and hardware store and the Arcadia Hotel. The first alarm of fire was at 4:15 A.M. when a hotel tenant was awakened by the crackling of flames and the smell of smoke. Two engine companies were employed, as high winds (30 m.p.h.) fanned the fire disastrously. There was no loss of life.

Aug. 6, National City, Calif. Group Fire. $350,000.

All the ingredients of a disastrous fire—frame constructed buildings, highly flammable contents, delayed discovery and inadequate water supplies—were present in this conflagration which destroyed a Navy warehouse, the National Research Laboratories, the Ace Van and Storage Company, the Sperry Flour Mill and the Stewart and Bennett Manufacturing Company. Flames were first observed by a night watchman in a plant across the street from the Navy warehouse at 12:30 A.M. After an unsuccessful attempt to call the fire department, the watchman hailed a passing motorist to give the alarm. City equipment was aided by the San Diego and Navy fire departments in a 12-hour fight to subdue the flames from totally inadequate 4-in. mains, which forced the use of bucket brigades to supply water tank trucks and the pumping of salt water from the Bay to a pumper. A million pounds of wiping cloths and 136,000 pounds of cotton waste in the Navy warehouse prolonged the fire as flammable chemicals and volatile liquids in the Laboratories (producing air ducts for Navy bombers) caused explosions and spread the flames in all directions. An estimated $100,000 loss was sustained to household goods in the

Part of the ruins after the fire of August 6 in National City, Calif.

Storage Company property, delaying scheduled occupancy of a housing development in the locale. Cause of the fire is unknown, although spontaneous ignition is suspected.

Dec. 3, Atlanta, Tex. Mercantile Block. $300,000.

Fanned by cold stiff winds, fire of undetermined origin started in the Atlanta Electric Company Store, spread out of control and swept through three buildings to destroy eleven mercantile stores. Discovered about 5:00 P.M., the three two-story structures were quickly involved and help was requested from Texarkana, Linden, Jefferson and the Vivian Lone Star Ordnance Plant. For a time it appeared certain that the entire business center was doomed. Effective fire fighting confined the fire, however, except that at 9:00 P.M. a near-by grocery and adjoining furniture store were destroyed by a fire supposed to have originated from embers or sparks which burned through the roof of the grocery during the earlier fire. No one was injured. Preliminary newspaper estimates place the loss at $300,000.

Dec. 11, North Beach, Md. Mercantile Block. $300,000.

A drug store, department store, grill, hardware and furniture company, and lumber yard were destroyed by fire which leveled two-thirds of a block of stores and apartments in the center of town. First discovered at 5:15 P.M., the blaze is said to have started from an overheated coal stove in one of the eight second floor apartments in the frame building. The local fire department called on ten near-by communities for assistance and water was pumped 350 ft. from Chesapeake Bay to supply hose streams.

Dec. 17, Toronto, Ontario, Can. Mercantile Group Fire. $250,000.

Preliminary reports indicate that fire caused damage to about thirty mercantile and manufacturing concerns as it swept through a block of buildings at Richmond and Victoria Streets. Near zero temperatures complicated fire fighting efforts, but building construction and flammable contents were chiefly responsible for the large loss. Said to have started in a restaurant on the ground floor, the fire spread rapidly through the three-story block and threatened exposures as a strong wind fanned flames to a height of 100 feet. A series of explosions in the rear of the building, believed to have originated from paint and rubber cement cans, occurred as the roof collapsed. Tightly packed burning mattresses on the third floor were exceedingly stubborn to extinguish. Many of the occupants were jewelry manufacturers.

Multiple Occupancies.

Jan. 6, Wheeling, W. Va. Paper and Metalworker, Sprinkler, Warehouse. $290,000.

At the time of the fire on Saturday morning, January 6, the one-story, sprinkler-protected, brick-joisted building occupied by the warehouse of the Globe Automatic Sprinkler Company was shut down for the weekend with one maintenance man and one watchman on duty. The one-story, brick-joisted, sprinkler protected Ackerman Plant No. 2 of the Wheeling Steel Corporation, adjoining and separated from the Globe Co. warehouse, also had a skeleton crew employed, mostly in the welding department. The Ackerman plant had changed shifts at 7:00 A.M., and conveyors and machinery in the plant were shut down with the exception of three projection electric spot welders operating near a 3500-gallon unprotected paraffin dip tank at the southern end of the building. At 7:40 A.M. an operator of one of the welders noticed a spark from the welding machine settle on the metal hood over the large paraffin dip tank. The fine dust caused by sawing paper bomb rings had settled on this hood and being impregnated with paraffin was instantly ignited by the spark. The employee used a chemical hand extinguisher at this location to extinguish the fire, but only caused it to spread upward with greater rapidity. Within two minutes practically all of the sprinklers, controlled by two dry pipe valves, approximately 300 heads, had fused. The speed with which the fire spread throughout the wood roof structure by paraffin laden dust particles which had adhered to the wood roof rapidly caused it to be beyond control of the sprinklers. Although no one in the plant could definitely establish the exact time the paraffin in the tank and the two tons of

Excessive hazard from a 3500-gal. unprotected paraffin dip tank caused this fire which overtaxed the water supply and sprinkler system at the Wheeling Steel Corp. plant on January 6.

Two persons lost their lives as a result of the Milner hotel fire in Lima, Ohio, on January 7. Starting in a third floor linen closet, the fire burst out with explosive speed to envelop the floors above. Open elevator and stair shafts spread the flames with incredible rapidity and could not be used as a means of escape by the trapped guests. Despite immediate fire department response the fire spread so rapidly that the loss was $315,000.

solid paraffin in storage ignited, it was the opinion of employees that this material only contributed to the intense heat of the fire and was ignited after materials on the floor had been saturated with paraffin, and falling members from the roof had ignited the materials.

At 7:45 A.M., the first alarm was turned in by a plant guard from a public alarm box located 150 feet from the guard office. Three city fire department companies responded to the first alarm. By their arrival the fire had burned through the roof, and a second alarm was turned in calling out two additional companies. Hose lines were laid to three public hydrants, and 200 feet of hose in the private hose house of the Globe Automatic Sprinkler Co. plant was put in service, but due to the drain on the water supply through the two sprinkler systems, which were in full operation, this supply was found to be inadequate. Two additional companies responded to a third alarm which was sent in at 8:03 A.M.

Fed by liquid paraffin, the fire quickly consumed all combustible material within the south section of the Ackerman Plant. During this time the wood roof and monitor of the adjoining sprinklered property occupied by the Globe Automatic Sprinkler Company ignited due to heat from flames being swept over an 18-inch parapet of an 8-inch brick division wall by a moderate wind from the north. The fusing of sprinklers and breaking of sprinkler lines within the Globe property due to roof collapse caused additional drain on the water supply, which was already inadequate to control the fire. The sprinklers on the system in the section of the Ackerman Plant north of the section of origin fused due to heat through unprotected openings in a division wall, but failed to function due to lack of water, there being insufficient water by this time to sound the alarm.

The Ohio River is within 500 feet of these properties with a railroad intervening and with no road or ramp to this source of water supply for fire department pumpers. There were four private double hydrants and four public triple hydrants available at this location supplied by a dead-end eight-inch yard main connected to a six-inch city main. The hydrants and all sprinkler systems of both these plants obtained their water supply from this source, which, due to excessive hazard, proved inadequate to control a fire of major proportions.

Jan. 7, Lima, Ohio. Milner Hotel. Multiple Mercantile Occupancy and Hotel. $315,000.

All buildings involved in this fire were of ordinary brick-joisted construction, principally five and three stories in height. Buildings were old, but in good repair. Evidence indicated rather conclusively that the fire originated in a 9 ft. x 12 ft. soiled linen room on the third floor of the hotel located adjacent to a 12 ft. x 12 ft. air shaft. This shaft began as a skylight from the ceiling of the drug store on the ground floor of the hotel, and extended as an open shaft with no roof covering on up through the roof of the main building. There were two such shafts, each with sheet metal sides and with window openings on each floor. The fire was discovered about 2:00 P.M. Sunday afternoon by one of 128 guests. A puff of smoke was seen by a guest coming through the upper part of the door of the third floor linen room, and reported immediately to the hotel manager, who called the fire department. Guests on the fifth floor were then called by telephone, but that floor was already filled with considerable smoke. Apparently at about the start of the fire there was a mild explosion which blew out a window in the shaft, including its frame, followed almost immediately by flames from the window which reached to the roof two stories above. It is believed that there may have been several gallons of insect spray base in the linen room and it was thought possible that previous excessive use of insecticide may have aided in the rapid spread of fire.

Fire department response was immediate following a few minutes confusion in connection with the source of the alarm. By the time the fire department reached the scene the fire had reached such proportions that a second alarm was immediately sounded, bringing three additional fire companies, and all off-shift firemen were called. It was evident that a number of guests were trapped in various rooms, and as a result all efforts of the fire department during the first fifteen or twenty minutes were directed toward the saving of lives. One guest was standing on a window ledge on the fifth floor overlooking the street. He was practically enveloped in flames and a life net was spread immediately by firemen, who called upon him to jump. He did so, but the force of his fall broke the net and he fell through to the cement walk. He died several hours later, and the attending physician stated that his death was probably the result of third degree burns rather than the fact that the life net had failed.

Another victim of the fire was a woman occupying a room on the third floor facing the street. She was sitting on the window ledge, waiting to be rescued. As there were no flames or smoke in her immediate vicinity, firemen intended to rescue those who were in immediate danger, and to return to her later. Civilians took the broken net and attempting to hold the

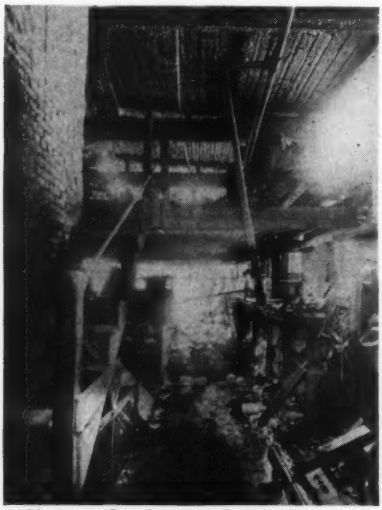
canvas with their fingers against the rim urged the woman to jump. Instead of jumping she slid off the ledge, fell on an iron railing, finally landing in the net lifeless. Other guests were all removed from the building, and although several were seriously burned, all recovered.

During the time the rescues were being made, the fire spread rapidly and soon enveloped the entire building, its spread being accelerated by open stairs, elevator and air shafts.

The fire department performed good work in preventing further spread of fire. A building located 66 ft. across the street ignited on the fourth and fifth floors from radiated heat. This fire was promptly extinguished with small hose. Temperature during the fire ranged from zero to ten degrees above, and many sections of hose were frozen before they could be rolled up after the fire.

Jan. 13, Philadelphia, Pa. Multiple Occupancy Textile Plants. $1,000,000.

Three multiple occupancy mill buildings, occupied by the Vigilant Mills Co. and the A. M. Townson & Co., Inc., were completely destroyed and five other sections of the plant were damaged when a fire, reported at 4:19 A.M. by a civilian outside the plant, swept through these one and three-story brick, plank on timber buildings. Fire is believed to have been started accidentally or deliberately by participants of a drinking party. On the second floor of one of the destroyed buildings, the body of one man of the party was found after the fire. Flames spread rapidly due to obstructed and corroded sprinkler equipment and weak water supplies. There was no watchman service in the section where the fire started and the fire made great headway before the alarm was given. Twelve 1½-in. and twenty-three 2½-in. hose streams were used in controlling the flames. There is conjecture that sprinkler valves may have been closed in the area where the fire started. Sprinklers in several of the buildings were badly corroded and did not operate, and storage of cotton fabric in high piles is believed to have obstructed sprinklers in some plant areas.



Obstructed and corroded sprinkler equipment contributed to the spread of fire in the Vigilante Mills Co. at Philadelphia, Pa., on January 13.

Jan. 17, Spartanburg, S. C. Variety Store—Mercantile. $240,841.

Fire, discovered by an employee of a cafe across the street at 5:28 A.M., totally destroyed the two-story and basement, ordinary brick, wood-joisted mercantile building occupied by the Silvers 5 and 10c store and spread with slight damage through wood joists extending through a brick party wall to the Efird's Department Store. Exact origin of the fire in the basement storeroom is unknown. Fire spread rapidly through air-conditioning ducts from the basement to the second floor. Roof and basement were burning before the main floor ignited. Firemen were hampered by lack of window or door acceess to the basement from outside the building.

Jan. 20, Presque Isle, Me. Multiple Occupancy Theatre and Business Block. $400,000.

Fire, thought to have been extinguished, rekindled in a second-floor theatre in a large three-story brick-joisted business block housing three mercantiles, a bank, theatre, Red Cross room, radio broadcasting station, and apartments. A fire was discovered in a gallery seat in the theatre following the evening performance. The projection room operator and the theatre manager believed they had extinguished the fire with a hand extinguisher, but flames later were discovered issuing from windows of the theatre section. Fire spread through ventilators to the open attic, and firemen were forced to rescue residents on the third floor. The block was completely gutted. Records in a bank vault were found in perfect condition, following removal of ice and debris.

Jan. 28, Port Henry, N. Y. Multiple Occupancy Mercantile, Lodge Rooms and Apartments. $300,000.

Fire of unknown origin was discovered at 8:30 A.M. Sunday morning in the basement of a store in the Knights of Columbus block. The three-story brick-joisted, brick veneer and frame building, which had two open stairways, was without automatic sprinkler or alarm protection in the basement, as were the other buildings in the block. When discovered, the fire had made considerable headway and spread to an adjacent block and two apartments. Twelve hose streams were used to control the fire.

Feb. 3, Fort Worth, Texas. Mercantile, Restaurant and Office Building. $355,000.

Sailors passing this five-story brick-joisted structure discovered smoke and pulled a street alarm box at 1:07 A.M. Fire started in the basement at the wallboard partition of a washroom. Due to the construction of the building which consisted of numerous light wooden wallboard partitions, wood floor and ceiling channels without fire stops and open wood stairs, the fire was beyond control on arrival of the fire department. The fire department used twenty-eight hose streams, including ten streams from the standpipe system of a near-by building, but this large structure was almost completely burned out. This structure was erected in 1845 as an office building, later converted to a hotel and reconverted to an office building with mercantiles on the first floor and a restaurant in the basement. The present city building code, which is not retroactive, would require automatic sprinklers in the basement of this block.

Feb. 5, Kalamazoo, Mich. Department Store. $450,000.

Fire of unknown origin started in the basement of the J. R. Jones Sons & Co., 3-story brick-joisted, unsprinklered department store after employees had left about 6:20 P.M. for the day. Discovered at 9:25 P.M. by a passing police radio car and a fireman off duty, the fire was reported to be burning through the roof at the time. It had spread rapidly prior to discovery due to lack of automatic sprinkler protection which had been recommended 10 years previously for the 75-year-old building with open wood stairways and an unenclosed passenger elevator shaft. The building and contents were totally destroyed within an hour. Several shoe and clothing stores in the same fire area were severely damaged. Firemen

Kalamazoo Gazette.

No exit signs were needed in this department store in Kalamazoo, Mich., after a fire on Feb. 5.

made an excellent stop at a frame wall separating the department store from the adjoining stores. Twenty hose streams, including a ladder pipe, were used by the fire department.

Feb. 9, Fairmont, W. Va. Multiple Occupancy Theatre and Mercantile. $275,000.

Fire, discovered and reported by an apartment tenant at 2:45 A.M., destroyed this 3-story and basement, brick-joisted theatre, mercantile and apartment block. Of undetermined origin, the fire seemed to be centered near theatre rest rooms in the rear of auditorium, and the flames, which spread rapidly through the auditorium and superstructure of the stage, were beyond control of the fire department upon its arrival. Brick fire walls with few and well-protected openings, plus favorable wind conditions, aided the fire department in preventing spread of the fire to adjoining property. One fire fighter died as a result of smoke inhalation after working in an adjoining building.

Feb. 11, McKeesport, Pa. Multiple Occupancy Mercantile. $500,000.

Fire of undetermined origin started in the basement of a 5 and 10c store located in the Ruben Bldg., a four-story, brick-joisted business block housing clothing stores, restaurant, offices and apartments. A street box alarm was pulled at 1:05 A.M. Flames spread rapidly through store basements and upward through open elevator and ventilating shafts, involving the entire building. Fifteen engines and three

ladder companies from McKeesport and nearby communities fought the fire with numerous hose streams, preventing spread of fire to adjoining structures. The building was old style, with many wood partitions and doors in the basement unprotected by automatic sprinkler or alarm system.

Mar. 3, Independence, Iowa. Multiple Occupancy, Theatre, Hotel, Mercantile. $300,000.

Fire of unknown origin reported at 10:15 A.M. apparently started near the projection booth of the theatre, spread to the three floors of the theatre and to the hotel section before discovery. In addition the building housed a liquor store, telegraph office, tavern, express office, barber shop, and doctor's office. The theatre was located in the center of the hotel block. The buildings were unsprinklered three and four-story brick-joisted construction, with open stairways. Fire spread so rapidly that total destruction resulted, although fortunately all occupants escaped. Fire Chief Paul A. Saener reports, "We have fought this building on our blackboard for years and from every angle. However, it went just as we always figured it would if it got a start in the theatre." The fire department used 13 large and 4 small hose streams.

Waterloo Daily Courier.

Fire of unknown origin destroyed the Gedney Hotel block at Independence, Iowa, on March 3.

Mar. 31, Joliet, Ill. Multiple Occupancy Mercantile. $292,000.

Fire of unknown origin broke out at a sales rack and table full of windbreaker jackets on the first floor of a men's clothing store at 11:00

Fire, originating in clothing on a sales rack, destroyed two men's clothing stores and a second floor bowling alley on March 31, at Joliet, Ill.

Unprotected stairs and other interior openings were responsible for the rapid spread of fire through this mercantile group at Morristown, N. J., Sept. 2. Loss $280,000.

A.M. on Saturday morning. The fire department was immediately notified by telephone and promptly responded with pumpers and ladder trucks. In the meantime, efforts of employees to remove burning stock failed and the flames spread to the combustible insulation board ceiling suspended 4 ft. on wood lattice work, filling the entire store with heat and dense smoke. This concealed space permitted the rapid spread of fire throughout the 66 ft. by 158 ft. two-story and part basement brick-joist building. There were no floor openings, stairs to basement and to the second floor bowling alley and billiard parlor were from the outside only. Wired glass windows prevented serious damage to the lower floors of a six-story fire-resistive office building adjoining, though two frame penthouse cottages on the roof caught fire at 1:00 P.M. and were destroyed when the flames extended through the wood-joist on steel truss roof above the bowling alley.

June 17, San Francisco, Calif. Multiple Occupancy — Motor Transport, Warehouse. $260,000.

A 3:23 A.M. Sunday fire razed the Los Angeles-Seattle Motor Express Terminal and Warehouse and involved four adjoining warehouses (covering a half-square block) as delayed discovery permitted flames to go through the roof before the fire department reached the scene. An unknown civilian pulled a street fire alarm box and 21 hose streams were used from the 22 pumpers and a water tower. Unsprinklered frame construction throughout prevented firemen from limiting the spread of the well-advanced fire. Evidence indicated that the fire originated on or under the loading platform of the one-story building. Housekeeping was known to have been poor in the occupancy where the fire originated.

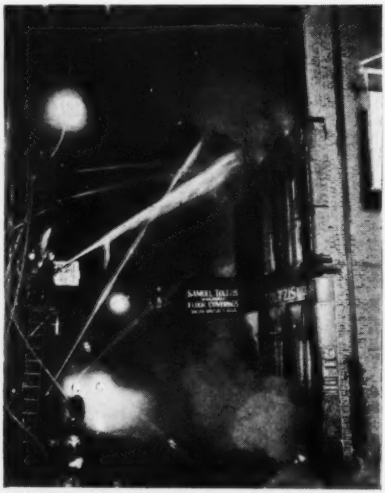
July 24, St. Paul, Minn. Multiple Occupancy, Mercantile. $283,106.

Lack of fire doors permitted a fire originating in a paper packing room in the basement of the multiple occupancy, St. Paul Business Real Estate Associates building to spread undetected until smoke was noticed issuing from the doors of the Niesner Brothers 5c to $1.00 store on the ground floor at 10:32 P.M. Response brought 16 engine companies, who fought the flames all night with 35 hose streams in a successful battle to confine serious damage to the building of origin. Lacking automatic sprinkler or alarm protection for the basement, the incipient fire apparently spread up an open stairway to upper floors and mushroomed, causing damage to ten retail concerns. The three buildings were three-story and basement brick, ordinary-joisted, fire-resistive structures, with numerous unprotected openings between all floors and in the basements.

Sept. 2, Morristown, N. J. Multiple Occupancy —Mercantile. $280,000.

Because stairs and other floor openings were unprotected against the spread of fire, a 1:00 A.M. Sunday morning blaze completely gutted the McAlpin Block in the business district of Morristown. First discovered by a woman tenant of a near-by apartment, the fire originated from an unknown cause on the first floor in space occupied by the National Shoe Store and spread rapidly through sheathing, floor-joist channels and unprotected floor openings to involve the entire building. Other occupancies included a department store, two jewelry stores, two women's shops, apartments, a dentist's office, a packing and shipping concern and an idle public hall. Most obvious lesson of the fire was that if interior construction had been as fire resistive as its 12 and 16-inch brick walls, the loss would have been slight. The area burned was approximately 15,125 sq. ft. and was 100 per cent subject to a single loss without sprinkler protection. Paid and volunteer fire fighters from Morristown and Morris Township responded with ten companies and battled the flames with large quantities of water to prevent further extension of the fire to other seriously exposed buildings which had ordinary window openings in exterior walls. Fourteen spectators were injured, one seriously, when two large plate glass windows blew out with great force (because of internal heat) and passed over the heads of fire fighters to shower glass among the bystanders.

Rutland, Vt., Nov. 23. Loss $250,000.



Philadelphia Inquirer.

Firemen used adjoining fire escapes to direct hose streams on this Philadelphia alley fire, November 26.

Oct. 3, Battle Creek, Mich. Multiple Occupancy —Mercantile. $250,000.

Four stores were destroyed and many others damaged when a fire set by a confessed arsonist swept from the basement of the Nancee Hat Shop through unprotected stairways to involve the entire Stone Arcade building. The unsprinklered retail store property was a combination of old style combustible construction, brick walls with wood-joisted floors and wood truss roof. The first telephone alarm was received at 2:51 P.M. and four minutes later a general alarm was sounded as fire fighters fought to prevent the fast spreading flames from entering the seven-story Post Building on the west and the Post Theatre. Assistance was secured from Fort Custer, Kellogg Field, Percy Jones General Hospital and the Kalamazoo Fire Departments both to fight the fire and to cover the city in case of a second alarm. The fire was stubborn and repeatedly broke out just as control would appear at hand. Flames were visible for over six hours. During the fire fighting an estimated million and a half gallons of water were poured on the burning structure. A confession has been secured from an eighteen-year-old youth to having set this and other fires in Battle Creek's mercantile district. Heaviest damage was sustained to the building, S. S. Kresge's 25c to $1.00 store, Reed's Shoe Store, the Martin Gift Shop and the Nancee Hat Shop.

Acme.

Danville, Ill., December 12. Another multiple occupancy mercantile fire discovered by a passer-by in the early morning.

Nov. 13, Guelph, Ontario, Can. Multiple Occupancy, Mercantile. $290,000.

The Bond Hardware Block was in ruins and nine business firms suffered damage as lack of fire cut-offs allowed flames to sweep the building. The blaze apparently had its origin in paint and oil stocks. Responding to a telephone alarm at 9:38 P.M. placed by a tenant of an adjoining building, heavy smoke was encountered by fire fighters as they attempted entry to the hardware store. The fire did not develop major proportions until about 10:45. Adjacent properties received showers of sparks, requiring fire fighters and citizens to divert their attention at intervals to prevent a possible conflagration. Heat from the blaze was so intense that water on the streets turned into clouds of steam. Beside the hardware store, a tobacco and news stand, barber and nut shops on the first floor and an apartment above were totally destroyed. An explosion of oil or paint blew out the front of the hardware store, and bursting rifle cartridges and shotgun shells handicapped fire fighting operations. The exact cause could not be determined, but the origin of the fire was apparently at the foot of the basement stairs.

Nov. 23, Rutland, Vt. Multiple Occupancy—Mercantile, Offices. $250,000.

Fire, originating in the cellar of a meat market, swept through the Gryphon Building, causing heavy damage to the three-story structure before fire fighters could reach the source of flames. Reported by telephone at 9:37 P.M., heavy smoke and counters piled high with stock hampered attempts at forced entry into the thirty-year-old brick building. Drums of dry cleaning fluid, oil, turpentine and paints fed the flames, which spread upwards through partitions to the wood roof. Electric wires on the street prevented successful use of an aerial ladder and delayed ventilation operations. Assistance from West Rutland and Proctor permitted use of 13 hose lines on the flames and limited the damage to the adjoining five-story addition to water and smoke. Tenants included the market, a grocery, and general merchandise store on the first floor, with numerous law, insurance, and doctors' offices above. The amount of loss was increased by the extent of smoke and water damage.

A watchman, leaving this Chicago plant unguarded the night of Dec. 23, returned the morning of the 24th to find flames destroying the property.

Nov. 26, Philadelphia, Pa. Multiple Occupancy —Mercantile, Storage. $500,000.

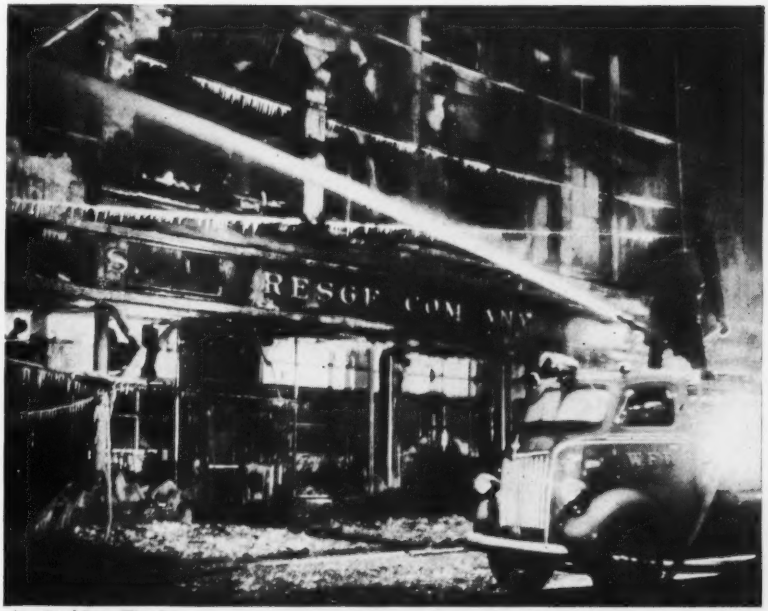
A four-alarm fire in four 100-year-old warehouses, located along an alley 15 ft. wide, forced Philadelphia fire fighters to climb fire escapes on adjacent buildings to direct effective fire streams into the four-story structures. Reported by police at 6:47 P.M., smoke was first observed on the second floor of one of the buildings. The flames apparently had a good start, because all four buildings were involved by the time equipment arrived on the scene. Starting in the S. Toltzis floor-covering store and warehouse, other property involved included a luggage firm, a general merchandise company and a novelty and rag rug concern. The buildings, of substantial brick construction, were completely gutted inside by the flames, and little salvage of stocks was believed possible. The narrow alleys were handicaps to fire fighters, and long hose lines from main arteries of the city were required. Twenty pieces of apparatus, including four ladder trucks, responded, but they could not be used to maximum effectiveness in the limited space. The four warehouses were approximately square, running 120 ft. along the alley.

Dec. 5, Hagerstown, Md. Multiple Occupancy— Mercantile, Offices. $250,000.

Fire of unknown origin destroyed the McCrory Building and wiped out large Christmas stocks of the Five and Ten and the Glick Brother Shoe Stores, according to newspaper reports. Discovered by a passer-by at 11:30 P.M., efforts of the understaffed fire department were greatly handicapped by heavy smoke and the head start given to the flames. Assistance was requested from Funkstown and Williamsport, but it was about 4:00 A.M. before the fire was safely under control. Offices on the upper floors of the building were also completely destroyed, but the adjacent properties were saved due to substantial brick walls and protection afforded by hose streams.

Dec. 6, Lexington, N. C. Multiple Occupancy— Theatre, Mercantile. $400,000.

Just twenty minutes after the alarm system had been restored, following damage by high winds and rain, a street box was pulled, sending fire equipment to the Carolina Theatre Building at 4:20 A.M. Discovered and reported by the building janitor, the fire had its center under the auditorium flooring, but had apparently been burning for some hours, as fire



Associated Press Wirephoto.

The Victoria Block, Windsor, Ont., December 24. Fire started in the basement and spread up an unprotected package chute. Fires in large, unsprinklered buildings of combustible interior construction, with unprotected floor openings, after they are once well under way cannot be controlled by even the most efficient of fire departments.

had spread through wood-studded partitions to the third floor and roof when the fire department arrived. While a fire wall protected the adjacent building and rain and sleet wet down neighboring roofs, the entire inside of the brick-walled, two-story building was gutted, with total loss to the theatre, two stores, a cafe, beauty shop and a dozen apartments. All sleeping occupants of the apartments were rescued by prompt fire department action. Absence of fire stops in the structure and delayed discovery of the flames were listed as contributing factors to the large loss by Chief Owen.

Dec. 12, Danville, Ill. Multiple Occupancy—Mercantile. $350,000.

A 5:00 A.M. fire gutted the Cannon Building, causing total losses to the Walgreen Drug Store, Cork's Restaurant, and heavy damage to a tavern and hosiery shop. The Thom McAn Shoe Store suffered only smoke and water damage due to the existence of a fire wall which was kept cool by hose lines. Discovered by a passer-by, the blaze was well advanced and the entire building was full of smoke, with flames coming through the roof by the time equipment reached the scene. The combustible contents of the two-story brick building, which had a frontage of 74 ft., fed the fire. Newspaper accounts state it is believed to have started near the kitchen of the restaurant. Thirty-five fire fighters used eight hose lines, but were handicapped by temperatures recorded at five above zero. A new aerial truck, three pumpers and a hose truck were used at the fire.

Dec. 18, Alexandria, Va. Multiple Occupancy, Mercantile and Apartments. $250,000.

The Del Ray Recreation Center and Apartment Building was destroyed by fire, making thirteen families homeless. Reported at 2:00 A.M., fire fighters worked twelve hours on the blaze before complete extinguishment could be accomplished. Besides the apartments, a bowling alley and eight other business establishments were total losses, as only the brick walls remained. All occupants escaped from the building, some in nightgowns and pajamas, in freezing weather. No cause could be attributed to the fire because of its delayed discovery and extent.

Wired glass windows in adjacent buildings proved effective fire stops in this fire in Renberg's department store, Tulsa, Okla., on Dec. 19. Absence of automatic sprinklers or fire alarm service delayed discovery, and unprotected open stairs spread the flames to all floors.

Dec. 19, Tulsa, Okla. Mercantile. $500,000.

A fireman on his way to work pulled the street alarm box at 6:51 A.M. almost simultaneously with the tripping of a fire-damaged burglar alarm system in the Renberg Department Store. The fire was well advanced as equipment reached the scene and a second alarm was sounded at 6:57 to bring twelve engine companies to the scene. Another major fire alarm was recorded at 7:06 A.M., this latter call sending fire fighters to the Barnes-Manley Laundry in a different part of the city. The two fires resulted in losses estimated at $1,000,000 in one morning. City officials are currently investigating both fires, but the Renberg blaze, in preliminary reports, was thought to have originated from an overheated air duct under the balcony over the first floor. The building involved was a three-story brick structure, with wood floors and roof (composition surfacing). Unprotected open stairs gave the flames access to all floors, as absence of automatic sprinklers or fire alarm service delayed discovery until smoke was visible to the passer-by on the street. No watchmen were employed. The building and combustible stocks were almost totally destroyed, but adjacent buildings suffered only smoke and water damage, wired glass windows proving effective fire stops. The loss has not been adjusted, but damage to the Renberg Store alone will approximate $410,000, including business interruption losses.

Dec. 24, Chicago, Ill. Multiple Occupancy—Warehouse and Mfg. $250,000.

A watchman hired to patrol the second through fifth floors of Midwest Textile By-Products Company occupancy of the Eagle-Picker Lead Company building was A.W.O.L. when a fire broke out at 5:09 A.M. on December 24. In a curious set of circumstances, the sprinklered six-story and basement, mill-constructed building was badly damaged through the fifth and sixth floors, with additional loss involving the second and third floors, collapse of upper portions of the walls, and damage to machinery and stock.

At 10:30 A.M., December 21, a fire caused by sparks from a rag-picking or shredding machine, igniting lint and dust, occurred on the fourth floor. Some sparks dropped to the third floor through an unprotected opening. Three sprinklers on the fourth floor and one on the third, plus efforts of employees, extinguished these flames and the Chicago Fire Department was not called. The sprinkler system was shut off to replace the fused heads. During this time, employees on the sixth floor noticed smoke, and investigation showed the fifth floor to be thoroughly involved in flames. The fire department was called and the sprinkler system turned on. Eighty-six sprinklers were fused on the sixth floor and ninety-six on the fifth floor during this fire, which caused considerable damage to machines and stocks because of water damage from the sprinklers and hose lines. After the second fire, the entire sprinkler system was shut off and drained to prevent freezing because the heating system was out of service. The textile concern hired contract watchmen to patrol the premises 24 hours a day. It was one of these watchmen who left the plant unguarded during the entire night of December 23 to return at 7:00 A.M. the 24th and watch a fire of unknown origin destroy the property. The third fire, which required twenty high pressure hose streams to control, was reported by the watchman of a near-by warehouse. Despite the good construction of the building, numerous violations of fire regulations had been noted three months previous, and. after checks revealed non-compliance with fire department regulations, court action was recommended on December 21. The occupancy of the floors involved included storage of baled rags and finished products, paraffin processing, shredding and picking of rags, and storage of lead, tin and other metals.

Dec. 24, Windsor, Ontario, Can. Mercantile. $300,000.

Seventy Windsor firemen battled for seven hours in freezing temperatures in an attempt to save the Victoria block from complete destruction after an alarm given by a passer-by shortly after midnight. The entire three-story, 50-year-old building, housing a large S. S. Kresge store, offices and the Windsor Business College, was a charred empty shell at 8:00 A.M. The adjoining Woolworth Building and a fur store were saved despite the constant threat of the flames, which were blown by a strong wind. The second and third floors of the building collapsed within twenty minutes of each other and sparks flew into the street. The fire started at a defective gas water heater in the unsprinklered basement of the Kresge store, and spread up an open package chute to the first floor, then up open stairways through the old brick-joisted building. There was no means of ready access to the basement for fire fighting, and the construction of the building was such that the structure was doomed from the start, despite efficient work by the Windsor Fire Department.

Laundries and Cleaners.

Feb. 13, Baltimore, Md. Wiping Cloth Factory. $375,000.

The Allied Laundry Co. plant, laundering rags, sorting and packing them as wiping cloths for the U. S. Navy, was destroyed by a five-alarm fire. It is believed that origin of the fire was from overheated cloths found burned on the inside of a steam heated metal drying tumbler following the fire. The plant covered an area of 12,500 sq. ft., with one-story and three-story brick construction, including six former dwellings converted to laundry use. There were numerous unprotected floor and window openings. The fire was reported by an automatic fire alarm system at 3:23 A.M. Due to rapid heat changes in the drying section where the fire originated, high degree thermostats had been installed. When the first firemen arrived the entire first floor was involved and flames had spread upward to the third floor. The fire department sounded a second alarm at 3:30 A.M., with three others following in 37 minutes. A high pressure boiler, located in cut-off section of ordinary construction, was undamaged by the fire. An adjoining sprinkler-protected, three-story, brick-joist building occupied as an oakum factory was separated from the wiping cloth building by a brick division wall extending only 4 inches above the roof with composition roofing over the wall. Fire spread over the division wall in the composition roofing and ignited the roof sheathing of the adjoining building. Three sprinkler heads operated and extinguished the fire on the underside of the roof and the fire department used hose streams on the roof and confined the fire to slight burning of the roof.

Oct. 10, New York City (Bronx), N. Y. Carpet Cleaners. $1,000,000.

The one-story, large area Sutton Carpet Cleaners' plant suffered a serious fire caused by a spark from a portable cleaning machine using naphtha. Eighty per cent of approximately 10,000 rugs on the premises were damaged or destroyed, causing an estimated loss of $1,000,000, mainly uninsured. As opposed to this figure, damage to the building has been officially set at only $23,000 and to other contents, $17,000.

Dec. 19, Tulsa, Okla. Laundry. $500,000.

Explosion of leaking refrigerant has been blamed for this Barnes-Manley Laundry plant fire which followed by only fifteen minutes the major fire at the Renberg Clothing Store in the same city. The explosive nature of the origin of the fire sent flames throughout the entire half-block building. A clothing vault, by early reports, was believed to have saved considerable amounts of clothing, but sealing of the vault door by the intense heat of the fire delayed investigation. Investigation by local authorities is in process after the double disaster. Fire fighting at the laundry was hampered by frozen hydrants.

Rubber Manufacturing.

Jan. 15, Fremont, Ohio. Synthetic Rubber Compounding. $275,000.

This unsprinklered, unprotected plant of ordinary brick-walled, wood-joisted roof construction, approximately one acre in area, occupied by the Fremont Rubber Co., was engaged in synthetic rubber compounding, and its destruction caused interruption of processes and loss of critical materials vital to the war effort. Fire, probably caused by an electric spark igniting dust, principally carbon black, occurred in a compounding room and spread throughout the entire one-story section (approx. 38,000 sq. ft.) and a two-story section (2400 sq. ft) with unprotected openings, with almost inconceivable rapidity. The plant was located outside the Fremont city limits, and there were no fire hydrants available.

Employees working in the compounding room at 3:35 A.M. saw a flash near electric switches where power lines entered the building. Fire spread almost instantly to the entire roof of this room. An employee attempted to telephone an alarm, but was unable to complete the call before he was forced to run. Attempts to use fire extinguishers were similarly abandoned. The fire flashed from room to room in a manner indicating that deposits of dust created a highly combustible condition. An alarm was turned in by police radio from a squad car when flames were noticed from the downtown area. A booster truck with water tank responded, but as the entire structure was involved no effort was made to fight the fire. Various theories as to the cause of the fire were advanced, including sabotage by prisoners of war employed at this vital war plant, but housekeeping conditions in the compounding room are said to have been extremely poor; adequate ventilating and dust collecting systems and protection had not been provided.

Louisville Courier-Journal.

This butadiene plant explosion and fire in Louisville, Ky., June 17, 1945, caused damage estimated at some $500,000. While the loss was important, it was said not to have had any serious effect upon the synthetic rubber program. In the design of this plant, operated for the account of the government, the unusual fire hazard had been taken into account and the property was divided into a number of independent production units. Adjoining units were saved by operation of a water spray protection system recently installed. For safety reasons the butadiene escaping from the ruptured piping was allowed to burn until the source of supply could be valved off.

June 17, Louisville, Ky. Butadiene Plant. $500,000.

Preplanning paid huge dividends when this fire occurred, for the entire butadiene plant, owned by the Rubber Reserve Division of the R. F. C. and operated by the Carbide and Carbon Chemical Corp., might easily have been destroyed. Instead, the unusual fire hazards of the gas had been analyzed, and the plant was divided into a number of independent production units with special water spray fire protection systems installed to prevent spread of fire to other sections. The butadiene escaping from a ruptured pipe was allowed to burn freely until the source of supply could be safely valved-off in order to avoid danger of explosion. The fire started from a violent explosion in one unit of the "Conversion Area" when explosive vapors were pulled into an air compressor and became ignited by a preheater. Segments of the tank severed, and ruptured pipe lines full of flammable materials ignited. The plant and city fire companies responded with nine pumpers and, with the assistance of especially designed automatic deluge type tank spray systems, kept surrounding tanks and equipment cool by application of water through 20 hose streams until all lines feeding fuel to the fire were cut off. No injuries resulted from either explosion or fire despite the fact that flames rose 300 ft., homes several miles away were shaken, and final extinguishment was not accomplished for four hours.

Oct. 8, Emeryville, Calif. Rubber Manufacturing. $395,000.

The Oliver Tire and Rubber Company plant was totally destroyed by a fire caused by the ignition of a rubber solvent by sparks from an electric motor. Despite the fact that the alarm was transmitted automatically at 2:41 A.M. to the fire station located next door, the flames spread with such rapidity that fire fighters were forced to concentrate on saving adjoining property. Because of government demand for production, large quantities of rubber cement and highly volatile solvents were in the plant, which was on a 24-hour schedule producing rubber vulcanizing materials, diaphragms, tubes and valve sleeves. Open fire doors permitted the spread of fire throughout the 16,000 sq. ft., one-story, unsprinklered plant, which was of mixed brick, tile and corrugated iron construction. The Oakland Fire Department rendered assistance and eight hose streams were used on the fire and to protect an exposed ball park and a cleaning and dyeing establishment. Four employees and one fireman were injured in the three-hour fire.

Dec. 3, Texas City, Texas. Chemical Plant. $500,000.

This plant, owned by the Reconstruction Finance Corporation (U. S. Government agency) and operated by the Monsanto Chemical Company, was producing styrene for use in the production of synthetic rubber. Due to some unexplained failure in piping or process equipment in an alkylation unit during a severe rain and electrical storm, ethyl benzene was released and the resulting fire caused extensive damage to the specialized equipment. The final loss will probably be somewhat less than the preliminary estimate, but will be heavy.

Food Processing Plants.

Mar. 4, Pittsburg, Texas. Vegetable Dehydration Plant. $250,000.

Fire, originating from a rupture or leak in a substandard natural gas supply system, ignited by a pilot flame on a heating chamber, completely destroyed the 21,364 sq. ft. plant of Gilbert C. Wilson Laboratories at 5:30 A.M. A Sunday clean-up crew of 12 was preparing the plant for normal full scale production of dehydrated sweet potatoes under Army contract. The hollow tile walls and wood-joist roof collapsed as the flames were sent soaring through a tunnel drier, which was in partial operation (exhaust fan running) to assist in the cleaning of empty wooden dehydrating trays. Employees, escaping without injury, left doors open, which created additional drafts and spread the flames throughout the building. Finished materials of the previous day (greatest in the plant's history) were also totally destroyed because of lack of cut-offs. The plant was without sprinkler protection or private fire fighting facilities and was located outside the town limits. The dehydration process was newly developed and inadequate attention was given to protection of hazards involved in it.

May 25, Fratt, Texas. Bakery. $292,000.

Absence of public protection water supplies, and lack of fire division walls in a one-story building, 41,928 sq. ft. in area, were principal factors contributing to the total loss of the Grandma Cookie Company bakery in an early

morning fire. The plant was not in operation. Analysis of the cause was impossible because of the extent of damage, but an employee who slept in the building and discovered the blaze said it originated near one of the natural gas ovens, whose pilot lights were burning. Fire departments from San Antonio, eight miles distant, and Alamo Heights responded, but absence of water prevented effective fire fighting. As the brick walls collapsed when wood joist roof supports and wood flooring gave way, the fire extended to a storage battery concern adjacent and within 25 feet of the bakery across a railroad spur. Exposure loss would have been even larger had not the brick walls, wired glass and asbestos roofing of the battery company building acted as retardants.

May 31, Miami, Fla. Milk Bottling and Ice Cream Manufacturing. $350,000.

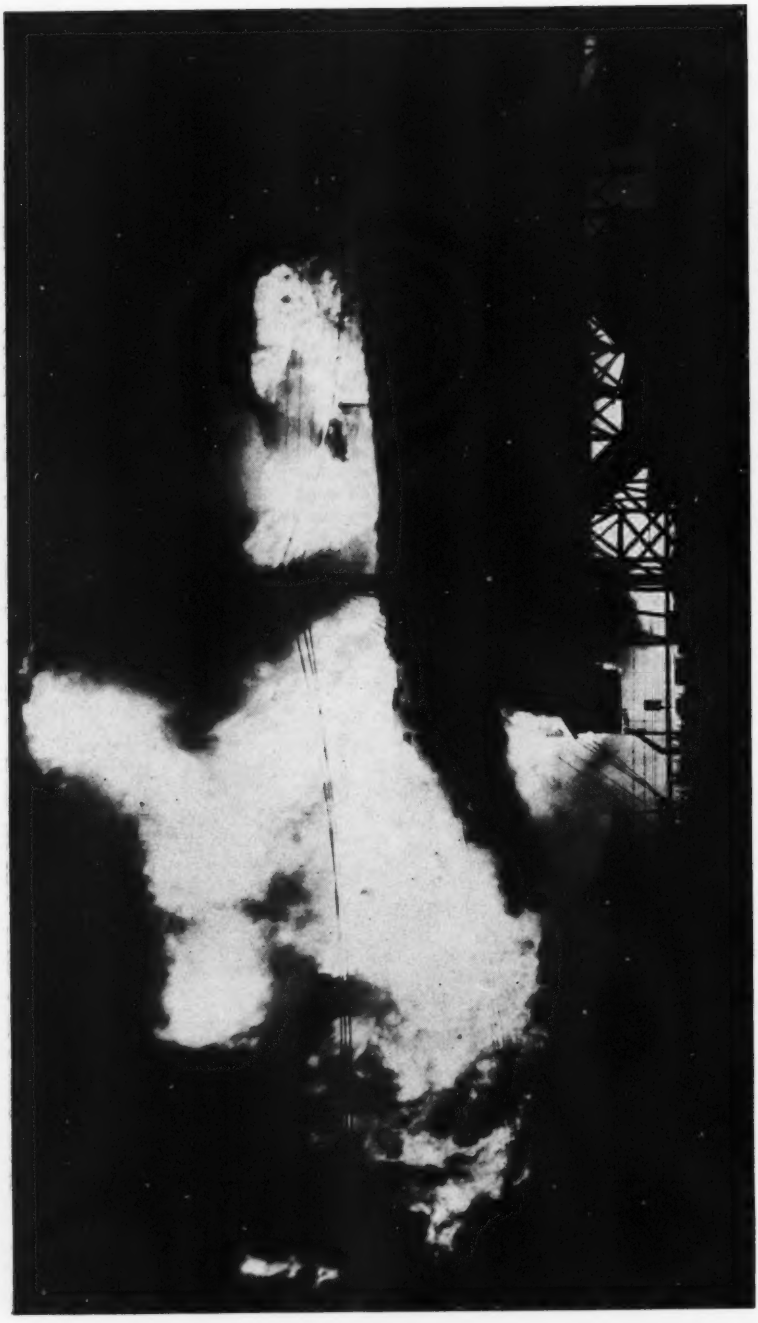
Release of ammonia gas by the failure of a 2-inch nipple on an ammonia compressor set off the first of three explosions at the Southern Dairies plant when the gas was ignited by a spark from a brush-type motor. The first blast attracted the attention of the relief engineer shortly after reporting for work at 5:00 A.M. His investigation revealed no flame, but a second explosion ten minutes later started a raging fire in the engine room. The fire alarm was telephoned at 5:18 and at about 5:20 a third and still heavier explosion spread fire in all directions. The apparent cause of the last blast was the rupture of a spare 150-pound ammonia cylinder. The engine room was located in a light, open-joisted frame building adjoining the main concrete block, one-and-two-story plant to the north, a corrugated iron on wood addition to the south, and was open on east and west ends for trucks to enter the building. Fire destroyed all four of the buildings, an area of approximately 25,000 sq. ft. The entire plant was unsprinklered, and the spread of fire was attributed to the explosion

San Antonio Express.

Grandma Cookie Co. fire, Fratt, Texas, May 25.

Texas Inspection Bureau.

Lack of safeguards and protection facilities for a newly developed vegetable dehydration process were responsible for the total destruction of the plant of the Wilson Laboratories, Inc., at Pittsburg, Texas, March 4.



Burning of the Citrus Concentrates plant in Dunedin, Forida, on August 27, 1945, with a loss of $2,200,000.

Miami Herald.

Inadequate water supplies hampered fire-fighting efforts at the Southern Dairies plant in Miami, Fla., on May 31. Release of ammonia gas, ignited by a spark from a brush-type motor, caused three explosions, and the ensuing fire destroyed the building.

and hot gases, the combustible roofs, the unbroken attic areas, and the fusing of ordinary glass windows. Fire fighting efforts were hampered by poor hydrant protection and the long hose lines consequently required, which greatly reduced the effectiveness of the hose streams.

Aug. 15, San Antonio, Texas. Peanut Shelling Plant. $410,500.

Fire, originating in the seed house of the San Antonio Oil Works (vegetable oil mill and peanut shelling plant), swept through five buildings of frame construction and six railroad cars before it could be stopped. The main, two-story oil mill and the stock pens of Swift and Company, both seriously exposed, were saved by fire fighters in a two-hour fight. Twelve engine companies were on hand after three alarms, the first at 6:20 A.M., and thirteen hose streams from public mains were used. Private yard hydrants on 4-in. mains were too close to the flaming structures. The concentration of highly valuable raw materials in two seed houses, a hull house, linter shed and meal building was largely responsible for the large loss, contents loss alone totalling an estimated $325,000. Management is quoted to have concurred in rebuilding with fire-resistive construction plus automatic fire alarm systems, as recommended by the San Antonio Fire Prevention Bureau for such occupancies.

Aug. 27, Dunedin, Fla. Citrus Juice Plant. $2,200,000.

The large, four-acre citrus juice plant, erected in 1942 by the U. S. Government and operated by Citrus Concentrates, Incorporated, was completely destroyed by fire as flames swept the undivided area. Originating inside the hollow wood finish of one of the trusses, presumably because of unapproved electric lighting installation, the fire was discovered by a watchman shortly after midnight. Despite the fact that the plant was equipped with automatic sprinklers throughout (supplied by a 100,000-gallon gravity tank and two 500-g.p.m. fire pumps), the fire could not be controlled due to the place of origin and its spread through the wood roof area, where joists formed open horizontal flues for the full 400 ft. length of the building. The joists were supported on built-up wood trusses sheathed with fibreboard without fire stops and provided additional avenues for

San Antonio Press.

Burning of a peanut shelling plant and vegetable oil mill in San Antonio, Texas, August 15. Loss $410,500. Frame buildings had neither fire cut-offs nor adequate fire protection.

the flames. While the sprinklers helped check the fire for a short time, the huge combustible roof area, the eventual sagging of the roof and breaking of sprinkler lines, and the large number of heads that opened, delayed discovery and the absence of an immediately available, trained fire department commensurate with the size and type of the hazard contributed to the large loss. (See October, 1945, QUARTERLY, pages 113-114.)

Sept. 3, Dundee, Ore. Nut Processing Plant, Fruit Cannery. $250,000.

Discovered by a watchman at 6:30 A.M. Labor Day, a fire which probably started from defective wiring totally destroyed the 70 x 214 ft. three-story frame Hudson-Duncan packing plant. Volunteer fire department equipment was required to travel five and ten miles from Newberg and McMinnville to reach the scene. Large unbroken frame areas, with unprotected openings, gave the flames ample opportunity to sweep the entire building and force fire fighters to limit their attack to exposures. A public 80,000-gallon reservoir with 4 and 6-in. mains provided water supplies to six 1½-in. hose streams used in wetting down the adjacent cannery with the help of a rain storm. The plant was not in operation at the hour of the fire.

Sept. 17, Tewksbury, Mass. Poultry and Animal Feeds. $400,000.

The Tewksbury plant of the General Foods Corporation was leveled by an early morning fire believed to have been caused by defective electrical wiring. Absence of automatic sprinkler protection, lack of a yard hydrant system or public water supply, and serious dust conditions were elements in the rapid spread of the fire. Discovered by a watchman at 5:07 A.M., the volunteer department answered and drafted water from a pond whose nearest edge was approximately sixty feet from the building. Assistance was requested and received from four other communities, but all except two sections were considered total losses. No fire stops were provided and the flames spread unchecked through the one and two-story plant, which had part brick and part wood walls, part joist and part plank on timber floors and roof. Recorded hourly watch service was provided, but both clock and dial were lost in the flames.

Dec. 13, Dozier, Ala. Peanut Shelling Plant. $400,000.

Newspaper reports indicate a large loss fire at the Dozier Peanut Company Shelling Plant and Warehouse. Further information is not available at this time.

Fire at poultry and animal feed plant, Tewksbury, Mass., September 17. No protection.

Dec. 24, Bellows Falls, Vt. Bakery. $250,000.

Weak water supplies and partial failure of the town's fire alarm whistle were contributing factors to the spread of this fire which destroyed the Zeno Bakery and two adjacent, three-story homes on Christmas Eve, according to newspaper reports. An oil-fired oven backfired and caused an oil pipe to break, showering flames throughout the cake room. The alarm was given immediately (6:45 P.M.) by employees and the oil supply cut off, but the fire spread as volunteer firemen failed to hear the whistle which did not operate properly. Inexperienced men had to be used in fire fighting until help arrived from Springfield and North Walpole after a call placed at 8:00 P.M. The quick-burning, four-story, frame bakery was totally involved within an hour and flames communicated to the two apartment houses on each side, driving occupants to the street. One Bellows Falls fire hose section burst and while a new section was being installed a nozzle froze (14° F.). By the time the nozzle was cleared, the hose itself was frozen. An ammonia tank explosion in the ice cream room further complicated efforts of fire fighters to control the flames.

Refineries.

Jan. 30, Cleveland, Ohio. Coke Oven and Solvent By-product Plant. $600,000.

Fire of undetermined origin started with an explosion at 10:45 P.M. in a 100,000-gallon benzol storage tank not properly diked, which contained 27,000 gallons of benzol. Buildings in this congested plant were of one-story, unsprinklered, non-combustible construction. Approximately 20% of the area of the plant, operated by the Republic Steel Corporation for the Defense Plant Corporation as a coke by-product plant, was finally involved in fire damage. Shortly after the first explosion a major explosion threw flaming liquid over the benzol plant and tank farm. The screen-type roof vent on the tank lacked means of protection against freezing, and the temperature was 4° below zero, or below the freezing temperature of benzol. The top of the tank was blown intact a distance of 130 feet. Only a few of the tanks at the plant were diked. Ditches, which were not filled or bulkheaded, contained the

A system of yard hydrants, recommended and completed shortly before the fire of Jan. 30, in this Cleveland benzol plant, provided adequate water at good pressure for both foam and solid stream hose lines.

plant piping, proved a hindrance to fire fighters and aided in the spread of flowing benzol throughout the area. Twenty-five heavy hose streams and foam equipment were used by municipal, plant and Coast Guard fire fighters. A fire protection system of yard hydrants, recommended and completed shortly before the fire, supplied by a 1000 g.p.m. booster fire pump, provided adequate water at good pressure for both foam and solid stream hose lines. Without the new system, the water supply would have been wholly inadequate to cope with this fire.

May 26, Port Arthur, Texas. Refinery. $300,000.

The Texas Company refinery engaged in war production was damaged by fire when one of several stills exploded and flames spread to the chiller room of the de-waxing plant. Cause and other details have not been reported, but the blaze required several hours of fire fighting by the Plant Fire Brigade before it could be brought under control.

June 16, Fort McMurray, Alberta, Can. Asphalt Refinery. $420,500.

A welder's assistant, armed with a fire extinguisher for the specific purpose of extinguishing falling sparks, was not watching as the welder was cutting holes in a guard plate for braces to a hopper at the end of a 180 ft. sloping log ramp. The enclosed ramp was used to feed raw materials and when sparks ignited a small area, flames were swept along the ramp and into the main separation building, which measured 50 ft. x 200 ft. Fanned by a strong wind, the fire spread disastrously within minutes and jumped to four other buildings separated by distances of 50 to 80 ft. The plant, owned by Abasand Oils, Ltd., was used for the production of asphalt, fuel oils, and by-products from tar sand deposits. Details on construction are not available nor are protection features known, beyond the fact that only company employees and volunteers were available to suppress the fire, which burned from 2:45 P.M. through the night.

Specialized Industries (Miscellaneous).

Mar. 18, near Cordova, Alaska. Fishing Boat Repair Shop. $250,000.

For the second time in 6 months, a large loss fire destroyed a salmon canning plant in this unprotected location. Fire is said to have started in the power plant of the Shepard Point Packing Company cannery, which was being used as a boat and engine repair station by several fishing companies. The fire quickly spread to the cannery and warehouse buildings. The loss included a well-equipped machine shop used in boat repair work. Loss of gill net boats, skiffs and gear was serious due to shortage of boat lumber, webbing for the salmon gear, string cork and lead lines. Employees' quarters 100 feet from the plant were not involved. Employees and Coast Guard vessels from Cordova, 6 miles distant by water, fought the fire. Low water pressure and frozen mains made fire fighting efforts futile.

July 18, Los Angeles County, Calif. Motion Picture Studio. $250,000.

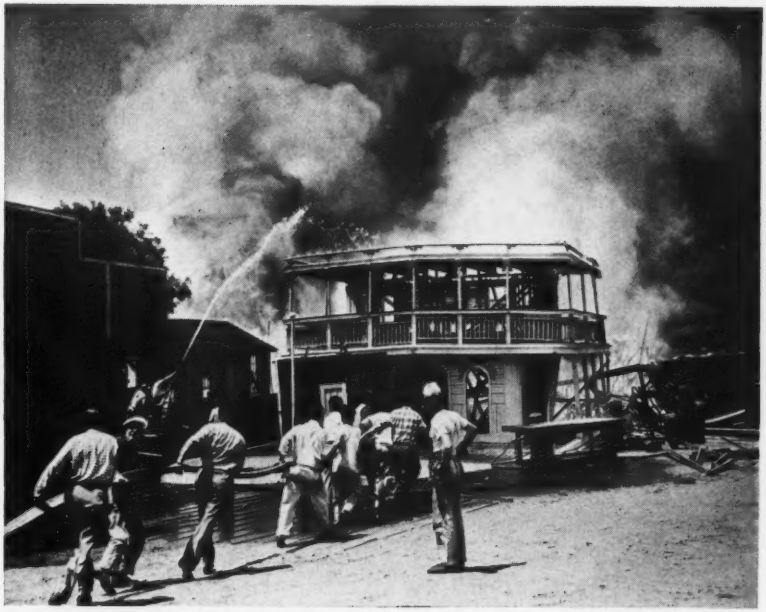
A "back lot" fire which broke out in the famous Tom Mix barn of the Universal Motion Picture Studios destroyed some $75,000 worth of 250-year-old carriages, buggies and other props, as well as a South Sea Island set and a portion of a "Western" street. Five or six acres were involved in the flames, but 20 children employed as extras on a picture under production escaped without injury. Fanned by strong winds, the frame structure burned with great rapidity as employees fought the blaze with private hose equipment.

Aug. 13, Detroit, Mich. Packaging Plant. $350,000.

Fifteen people lost their lives and forty-two others were injured when a flammable solvent was poured into an overheated, gas-fired, degreasing vat (designed for trichloroethylene), which started a fire that flashed throughout the Export Box and Sealer Company plant at 4844 Grand River Avenue. Water-proofed packing materials, waxed paper and wax containers, wood cases, chronically poor housekeeping conditions and two open wood stairways at the rear of the building leading to the second floor caused the rapid spread of this fire. Investigation developed the fact that the flammable liquids in the solvent storage room did not contribute to spread of the fire. Plant personnel inexperienced in the hazards of this warborn industry, lack of training in the proper handling of flammable liquids and failure to follow the provisions for stairways and enclosures of the N.F.P.A. Building Exits Code were all factors in the tragedy. While there were five exits from the ground floor, only one of the open stairways from the second floor led directly to an outside exit on the ground floor. The

Detroit News.

This fire in the Export Box and Sealer Company, Detroit, August 13, 1945, caused the death of 15 persons, injury to 42 others, and a property loss of approximately $350,000. The fire started in a degreasing tank supposed to contain a non-flammable solvent, but in which a flammable liquid was being used.



International News.

Fire, starting in the Tom Mix "prop barn" at Universal's Studio, Los Angeles County, on July 18, quickly spread to other combustibles over a six-acre area. Valuable antique stage properties and outdoor sets were destroyed.

rapid spread of fire trapped the majority of the personnel on the second floor, burning some employees to death within the building and trapping others as they sought escape through windows. A few were killed or injured in falls to the sidewalk from the second story. The occupancy of the building was originally registered with the city as a warehouse. This classification was not changed despite the introduction of obvious fire hazards. The fire marshal had ordered several inspections of the factory prior to the loss, and in April, 1945, had the plant closed due to housekeeping conditions found to be hazardous. Reopening was permitted the following day when a fire department inspection showed that the hazardous conditions had been improved. Apparently the improvement in conditions found at the time of the last inspection on July 28th was not maintained. The fire department had no authority over structural features of the building. Originally having only one unenclosed stairway between floors, a second stairway was suggested by the fire department and required by the building department, but when installed at a later date this likewise was open, providing additional draft for the spread of fire when it occurred. The Detroit Fire Department was summoned by a passer-by, but despite prompt response, effective rescue work was impossible. (This summary corrects minor errors in the October, 1945, QUARTERLY, pages 110-113.)

Oct. 28, Caribou, Me. Fertilizer Factory. $300,000.

Fire swept the one-story wood Aroostook Federation of Farmers' fertilizer factory and spread to the main mixing plant adjoining. Reported by employees of the Caribou Water Works, located 500 ft. away, by telephone at 10:10 P.M., the volunteer fire department was unable to stop the spread of fire through the 700 by 120 ft. plant, but was able to save three loaded freight cars, the office and other outbuildings. The plant had no automatic sprinkler or alarm service, but was provided with watchman service. There were no fire walls in the main plant. Interior conveyor systems ran the length of the structure. The night of the

nammable liquid was being used.

International News.

Explosions and fire followed when the tankers "Spring Hill" and "Clio" collided and a third tanker, "Vivi," was sprayed with blazing gasoline in New York harbor on Feb. 5. Seventeen lives were lost and 122 persons were injured.

fire, the 70-year-old watchman punched a clock at 9:21 P.M. and noticed two men in the vicinity of the barrel stave shed, but did not investigate. Fire broke out in this portion of the building and was observed by the watchman, who attempted to reach the office 200 feet distant, but collapsed while traversing the distance. Fire fighters used four hose streams from an eight-inch main in front of the plant.

Dec. 8, Cheswold, Del. Hatchery. $300,000.

Fire, originating in the incubator room of the Charles C. Marker Poultry Farm, caused a fire loss estimated by the Chief of the Cheswold Volunteer Fire Company at $300,000. The cement and cinder block, one and two-story hatchery was discovered in flames by the owner at 8:15 P.M. when lights in his home suddenly dimmed. From all appearances the blaze started from a shorted electric motor or an overheated incubator and quickly involved the entire building, which had a highly combustible wallboard ceiling forming a second floor loft. The large loss was attributed to the value of incubators, eggs and equipment, which made the establishment one of the largest in the community. Volunteer firemen from five Kent County companies were seriously hampered by lack of water, as only a ditch one foot deep was available besides 2500 gallons carried in water wagons brought to the scene. The Cheswold Packing Company's tractor-trailer of two 500-gallon wooden water tanks made three trips from Cheswold to the farm. Fire fighters saved exposed buildings, including the feed building, poultry houses, garage and the Marker home. Absence of fire stops in the loft contributed greatly to the rapid spread of fire throughout the hatchery.

Steamships.

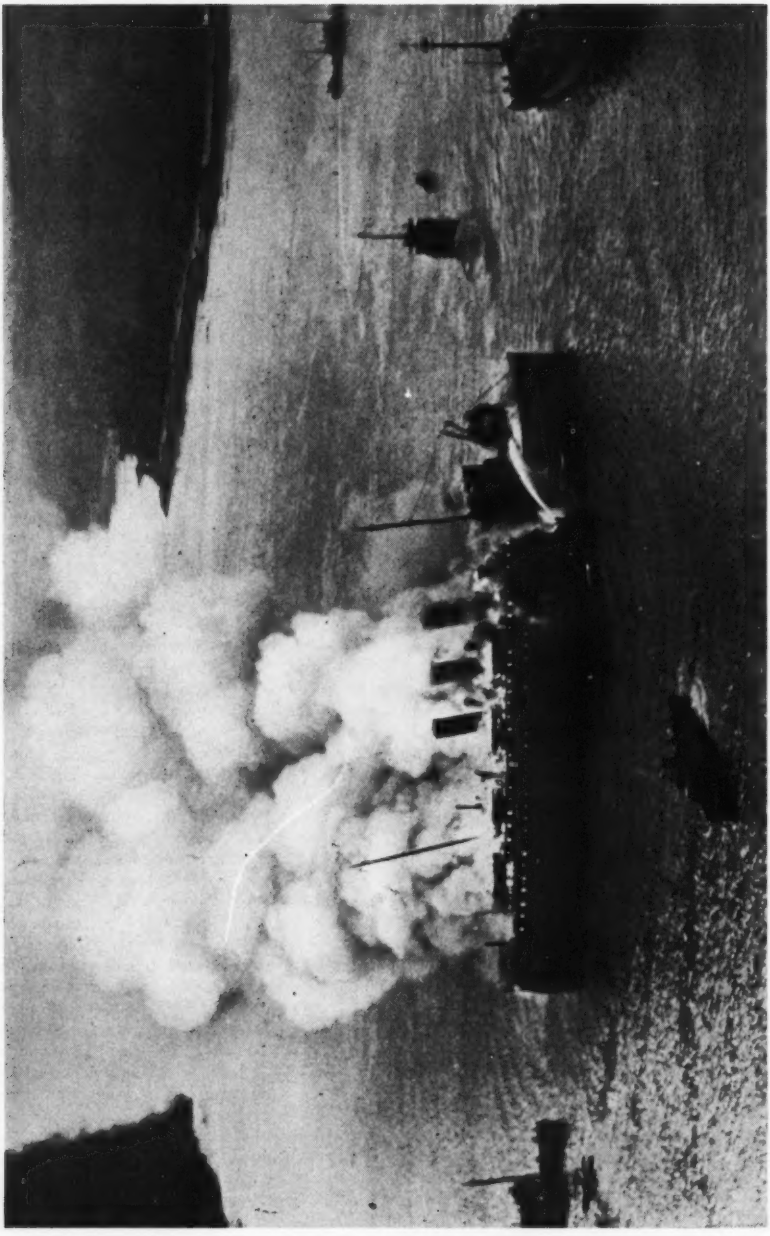
Feb. 5, New York Harbor. Tanker Collision and Fire. $2,000,000.

Explosions and fire followed the collision at 8:59 A.M. of the tanker *Spring Hill,* at anchor in the lower Basin opposite Pier No. 11, Brooklyn, and the 8000-ton tanker *Clio.* The *Spring Hill,* newly completed for the War Shipping Administration, was loaded with gasoline. Within two minutes of the initial explosion and while members of the crew of the Norwegian tanker *Vivi,* loaded with fuel oil and anchored 100 yards away, were attempting to rescue members of the blazing ships, the *Vivi* was sprayed with blazing gasoline. This third vessel was set ablaze and several crew members were killed at this time. Dragging her anchor, the *Vivi* steamed to the windward of the burning *Spring Hill* and remaining crew members extinguished the flames on this vessel. Water and foam were used by the numerous city and Coast Guard boats in attacking the flames on the *Spring Hill* and *Clio,* and in two hours the fire was brought under control. At least 17 lives were lost and 122 other persons injured.

Mar. 6, Vancouver, B. C. Steamship Cargo Fire and Explosion. $1,300,000.

The 10,000-ton "Victory" freighter, *S. S. Green Hill Park,* suffered a small fire in the hold at 11:45 A.M., followed by four distinct and major explosions within ten minutes, which forced longshoremen from initial extinguishment attempts, tore away the ship's side plating, and spread the fire to the main deck, bridge and deck housing. Six longshoremen and two of the ship's crew were killed, twenty-five injured and the explosion caused plate glass breakage over a wide area of the city. The cause has been definitely assigned (after full inquiry by the Canadian Department of Transport) to improper stowage of combustible, dangerous and explosive material and its ignition by a lighted match. Contributing factors included violation of the Explosives Act and Transport Commissioners Regulations, illegal smoking, and failure of supervisors to properly instruct and supervise the longshoremen and stowage methods employed. Ninety-four long tons of sodium chlorate, two long tons of calcium silicide, seven and one-half long tons of distress signals used as broken stowage, and ten and one-half long tons of overproof whiskey in 50-barrels were placed in No. 3 hold between decks, with such miscellaneous combustibles as varnished cotton cloth and cartons of personal effects. Some indications are that attempted pilferage of whiskey accompanied by an accidentally dropped match was responsible for the initial blaze. Fire protection equipment on the ship passed inspection the previous day and was used until smoke and the explosion forced abandonment. The City Fire Department responded with seven pumpers, three hose trucks, three ladder trucks and used twelve 2½-in. hose lines until the ship was towed away from the dock by tugs and beached. A city fire boat completed extinguishment after fifty-one hours, using over 9,000,000 gallons of water. Automatic sprinklers helped save the pier from extensive fire damage.

Explosions and fire followed when the tankers "Spring Hill" and "Clio" collided and a third tanker, "Vivi," was sprayed with blazing gasoline in New York harbor on Feb. 5. Seventeen lives were lost and 122 persons were injured.



Burning of the S.S. "Prince George," Ketchikan, Alaska, September 22.

Acme.

May 12, near Quebec, Can. Steamship. $500,000.

The *S. S. Moyra,* a 1400-ton cargo vessel, was gutted by fire of unknown origin which caused almost total damage to the full general cargo stowed above and below deck. The vessel was proceeding to Newfoundland when fire was discovered at 10:45 P.M. in the 'tween decks at No. 3 hatch and despite immediate efforts to extinguish the flames, using the vessel's fire fighting equipment and steam smothering valves, it increased in intensity. The vessel was beached at 11:20 P.M. and drums of acid and oil on the after deck were jettisoned. At 1:30 A.M. on the 13th, the vessel was refloated and proceeded at full speed towards Quebec, but was again beached (at the master's instructions) when the general service pump became choked with sand. The fire boat *Lanoraie* reached the vessel at 5:00 A.M. and another attempt was made to control the flames. With assistance, the *Moyra* was again floated and proceeded to Quebec accompanied by the fire boat. No success was achieved in the combined extinguishment efforts of the city fire department and the fire boat at the quay side and the vessel was again beached as heat drove all personnel from her decks. Harbor authorities hampered effective action by the city fire department because of a dispute over jurisdiction, which lasted for many hours. On May 14th, the fire was finally extinguished after holes were burnt in the ship's sides to allow the ingress of water at high tide, which flooded all remaining flammable material.

Sept. 22, Ketchikan, Alaska. Steamship. $500,000.

The 325-foot steamship *Prince George,* for twenty years a loyal servant of the Alaskan run, was totally destroyed by fire despite desperate attempts by city and coast guard fire fighters to extinguish the flames, of engine room origin. The alarm of fire at 8:10 A.M. was only ten minutes after the ship docked and this fact allowed 46 passengers to escape without injury. The crew of 50 stayed aboard in attempts to beat down the flames even after it was towed from the dock. As the fire became hopeless, the men were removed by the Coast Guard frigate *Annapolis* and the ship beached. No salvage could be effected as even the hull was buckled by the intense heat.

Burning of the S.S. "Prince George," Ketchikan, Alaska, September 22.

Acme.

Mills and Elevators.

Mar. 25, Jackson, Miss. Feed Mill. $275,000.

Fire of unknown origin started at 9:15 A.M. on Sunday under the feed storage section of this four-story plant handling mixed feed, corn, shucking, shelling, hay grinding and flour blending. The buildings were of frame and ironclad construction. The fire alarm was transmitted through the master fire alarm box by the operation of automatic sprinklers. Firemen sounded a general alarm upon arrival and with the aid of some 30 sprinkler heads and numerous hose streams, the fire was brought under control. The sprinklers were then shut off and overhauling with small hose streams began. Four hours after the original alarm, fire rekindled in a 6 ft. by 6 ft. grain bin in the four-story mill, resulting in a considerable dust explosion, which spread fire for 200 feet in the building. Fire companies were recalled and sprinklers were again turned on, aided by fire department connections to the sprinkler system. The fire was apparently being brought under control when the water supply failed due to depletion of elevated storage tank and difficulties in maintaining suction from rain-filled drainage creek. By the time the supply was restored, flames were beyond control in the feed and corn mill, grain bins, feed storage and mash-mixing building and a two-story storage warehouse. The fire was checked at a two-story section. Failure of sprinklers to hold fire to a small area in the original fire was, no doubt, due to unusual draft, and to the fact that sprinklers in roof monitor operated in advance of those along the roof. Under the conditions the sprinkler equipment was not considered to have failed.

Aug. 7, Port Arthur, Ontario, Can. Grain Elevator, $750,000.

The explosion and fire in the Saskatchewan Terminal Elevator No. 5 caused the death of 22 persons and injured 27 others. Investigation revealed that the Elevator fell far short of the N.F.P.A. Code for the Prevention of Dust Explosions in Terminal Grain Elevators, and that the chief elements causing the disaster were directly related to these substandard conditions. The factory inspection branch of the Canadian Department of Labour is presently drafting regulations to provide greater safety in grain elevators as a result of this tragedy. Ontario has already taken action to require installation of dustproof electrical fixtures and

Elevator explosion, Port Arthur, Ontario, August 7. Twenty-two dead. Property damage $750,000. The explosion wrecked the only stairway from the elevator head house, trapping five men. The small black spot against the sky in the middle of this picture is one of the men being rescued in a bos'n's chair 110 ft. above the ground.

switches, and instructions have been issued throughout the Dominion for at least two means of exit from each floor of all grain elevators. (See October, 1945, QUARTERLY, pages 103-107—also available in reprint pamphlet form.)

Aug. 31, Pendleton, Ore. Flour Mill. $250,000.

An early morning fire destroyed the Kerr-Gifford flour mill, originally constructed in 1888, and robbed the city of Pendleton of this important industry, which had a 700-barrel-a-day capacity. Only two frame warehouses east of the main mill were saved by fire fighters and a favorable shift of wind. Fire from an unknown cause was first discovered at 11:50 P.M. by a workman, who telephoned the city fire department. By the time of its arrival, the flames had spread so rapidly that workmen were just able to escape, and the three-story wood structure was a raging inferno, destroying between 50,000 and 60,000 bushels of wheat amid explosions of wheat dust. Five box cars on a railroad siding were lost as inadequate supply from six-inch mains hampered fire fighting. Dwelling houses in the vicinity were threatened, and residents were forced to protect their property with garden hoses. The mill was not protected by automatic sprinklers.

Columbus, O., Fire Prevention Bureau.

Grain storage bins of the Gwinn Milling Co., Columbus, Ohio, Nov. 3. Fire started in building at bottom of picture. Dust explosions damaged storage section, but owing to fire-resistive construction only 14 per cent of grain was lost. (See also photo page 221.)

Bus Howdyshell.

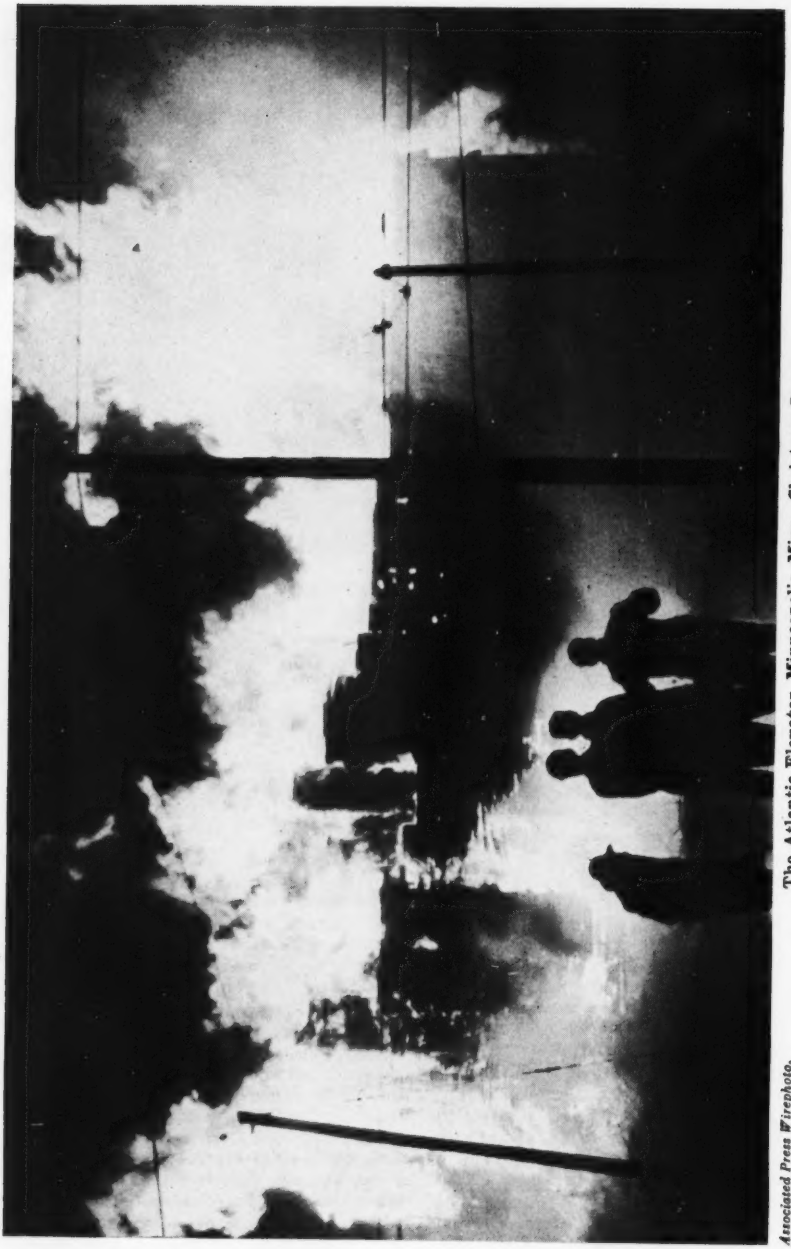
Burning of the Kerr-Gifford flour mill in Pendleton, Ore., Aug. 31.

Nov. 3, Columbus, Ohio. Grain Storage and Milling. $500,000.

Fire started in the grain drying area on the second floor of this brick and concrete Gwinn Milling Company building, with joisted and timber floors. A neighbor telephoned an alarm at 11:13 P.M. when flames were seen coming from windows of an area in which employees had supposedly extinguished a fire in the driers at 2:30 P.M. on the same day without notifying the fire department. After firemen arrived, the plant watchman ran from the building with his clothing ablaze. Before he died he told doctors that he fought the flames until driven from the building. Fire department officials believe the fire rekindled from the previous blaze. The automatic sprinkler equipment had been out of service for about three years despite repeated urging by the fire department that the sprinkler protection be re-established. The fire was fought with twenty hose streams, including two ladder nozzles and two turret streams. Streams were used in an effort to prevent damage to large concrete grain storage bins. Firemen were unable to confine the fire to the area of origin due to explosions which scattered fire over a large area, through open stairs, conveyors, shafts, and ducts. The dry house area and laboratory were totally destroyed, and equipment in the elevator was seriously damaged. An explosion in grain tanks in the upper part of the elevator blew off a portion of the roof. The flour mill was also seriously damaged, with upper floors and roof falling in. Only 14 per cent of an estimated 960,000 bushels of grain was lost as a result of the efforts of fire fighters and the fire-resistive construction of the bins.

Nov. 25, Baltimore, Md. Seed Processing. $800,000.

The entire south half of the new Southern States Cooperative seed processing and storage building was in flames when a radio equipped police car sent in an alarm at 4:33 A.M. The plant was not in operation and absence of automatic sprinklers or alarm equipment, plus no watchman service, gave the fire ample opportunity to spread, fed by an estimated 50,000 bushels of farmers' corn, soy beans, red clover and alfalfa. Completed last September, the steel-framed building destroyed measured 176 by 100 ft., and was seven stories high, with unprotected openings between floors. The walls of the first two floors of the building were cinder block-faced with red brick not tied in to the walls, and the five upper stories were covered with corrugated asbestos. Fire fighters



Associated Press Wirephoto. **The Atlantic Elevator, Minneapolis, Minn., Christmas Day.**

Columbus, O., Fire Prevention Bureau.

Gwinn Milling Co. fire, Columbus, Ohio, Nov. 3. Fire due to rekindling of a previously extinguished blaze started in the area shown in this picture and was spread by dust explosions. (See also photo page 218, which shows view above.)

were forced to retire three times to avoid injury from collapsing red brick facing of the walls. An exposed two-story brick warehouse only 25 feet from the burning structure was miraculously saved by fire fighters, who, on five alarms, brought 24 pumpers, 5 ladder trucks and a fire boat to the scene. Relaying operations were required, as nearest hydrants were 600 to 2000 ft. from the building and the fire boat's nearest approach was 1500 ft. away. A three-alarm fire at 11:15 A.M. in a rug cleaning company at another location gave the city its most serious multiple alarm fires within one day in many years.

Dec. 25, Minneapolis, Minn. Grain Elevator. $500,000.

Automatic alarm service in the Atlantic Elevator Company brought out sixteen pieces of the Minneapolis Fire Department at 2:10 A.M. Christmas morning. First firemen to arrive, when the fire was in its incipient stages, extended hose lines to the fifth floor of the 140 ft. elevator, but intense heat required withdrawal. Just as they cleared the building the first of two major explosions raised the roof and spread the flames disastrously. Their escape was termed "miraculous." A second explosion, presumably also of dust origin, further spread the fire throughout the old wooden structure which was about half-filled to its 500,000 bushel capacity. Efforts which were concentrated toward successfully saving houses in the vicinity were aided by a favorable wind. The fire brought Minneapolis' 1945 fire losses to an all time high of $2,400,000, according to newspaper accounts. The previous high was in 1911 when the loss was $2,123,647.

Dec. 30, Springfield, Ill. Grain Elevator. $300,000.

The night shift checked out at 1:00 A.M. At 5:50 A.M. a fireman on an Alton Railroad switch engine reported smoke pouring from the elevator. When the first firemen reached the Wiedlocker and Sons' Feed Manufacturing Company, the elevator was completely involved in flames. For the next four hours, six pumpers and three ladder trucks fought to confine the spread of fire and extinguish it. According to newspaper reports the 125 ft. elevator, mill house and warehouse were destroyed, together with 50,000 bushels of grain and 10,000 sacks of feed. A concrete warehouse and the office building were saved. An aerial ladder was used to permit fire fighters to get above the flames and use a deluge nozzle to effect large volume water discharge on the contents.

U. S. Navy.

Fire on Pier No. 3, Norfolk Navy Yard Annex, Norfolk, Virginia, Jan. 17, 1945, caused a loss estimated at several hundred thousand dollars. This fire is another illustration of the fact that no matter how well protected is the superstructure or how efficient the fire department, a heavy loss may be expected whenever fire reaches the combustible, inaccessible space under the pier deck.

Special Incidents.

July 28, New York, N. Y. Bomber Crash into Skyscraper. $500,000.

Full details of this tragic fire which cost the lives of fourteen and injured twenty-five were printed in the October, 1945, QUARTERLY, and reprints have now been made available in pamphlet form. At 9:45 A.M. a B-25 struck the Empire State Building with terrific force at the 78th and 79th floor level, causing flaming gasoline to be sprayed on the exterior and resulting in a flash fire in the offices occupied by the National Catholic Welfare Conference War Relief Services. Eleven employees were burned fatally within this office which, fortunately, contained only the Saturday morning "skeleton" force. Parts of the burning plane passed through the opposite wall and caused $75,000 damage to a penthouse apartment. The New York Fire Department utilized the building's fine fire protection equipment to maximum advantage, bringing the flames under control within 19 minutes.

July 18, Halifax, Nova Scotia. Munitions Explosions. Unestimated.

Fire, from an unknown cause, started on a wooden scow tied to a wood jetty in the Naval Magazine Area on the east shore of the inner Halifax Harbor, and caused an explosion of munitions aboard. Naval sentries reported the blaze, but the explosion showered flaming debris to large piles of depth charges stored in the open. A series of violent explosions followed at 6:35 P.M., 9:00 P.M., 12:00 P.M. and 4:00 A.M. The extent of these blasts is indicated by the fact that two craters measured 100 ft. in diameter by about 50 ft. deep. The most remarkable fact about the fire and explosions was that only one person, a sentry, was killed and five others wounded, although widespread damage to buildings forced evacuation of thousands from their homes. One report estimates private claims at $1,250,000, payable under the Canadian government war risk insurance. This loss does not include Naval Shore Establishment fire and explosion damage for which no estimate is available. Fire fighting efforts were constantly harassed by the explosions, but the blaze was halted before it reached the main magazine, said to contain 50,000 depth charges. The courage and coolness of the Naval fire fighters were highly praised in newspaper accounts and by other sources.

The west side of the Empire State building, showing flames issuing from the 79th floor during the fire that followed an Army bomber crash on July 28.

Piers and Shipyards.

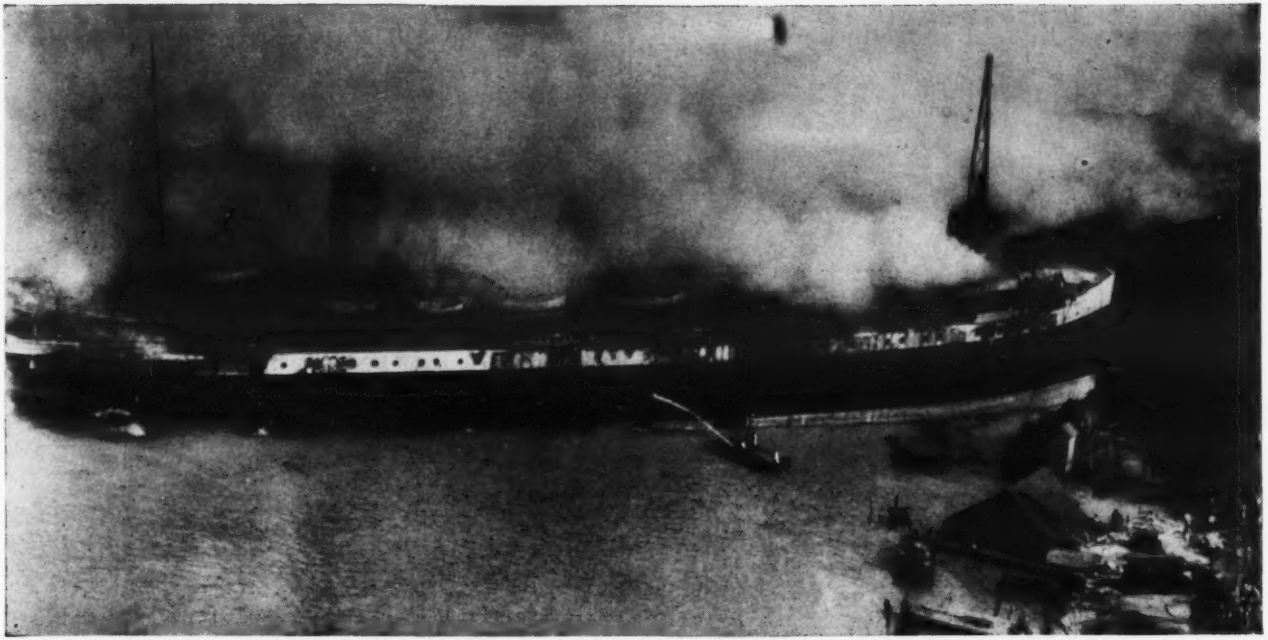
Jan. 17, Norfolk, Va. Navy Pier. $900,000.

Fire of undisclosed origin spread along Pier No. 3 at the Norfolk Navy Yard Annex and caused some damage to Pier No. 2. Several small vessels were also slightly damaged. Some planking in Pier No. 4 was torn up by fire fighters in their attempts to reach the fire. Fire involved the underpier area, creating intense smoke and required the combined efforts of public and private, land and sea fire fighting forces. Newspaper estimates place the loss at $900,000, but no official figures have been released.

July 17, Port Edward, Ontario, Can. Pier. $3,000,000.

Backfire of a gasoline-operated lift truck and consequent ignition of gas and oil around the motor started this large loss fire on a two-acre frame warehouse and wharf, which also destroyed a 365 ft. passenger vessel, railroad rolling stock and freight. Excessive areas of combustible construction without effective protection or fire stops permitted the flames to spread with great rapidity. Occurring at 8:30 A.M., the *S. S. Hamonic* was moored at the wharf with a passenger and crew complement of approximately 397. Many of the passengers

Fire on Pier No. 3, Norfolk Navy Yard Annex, Norfolk, Virginia, Jan. 17, 1945, caused a loss estimated at several hundred thousand dollars. This fire is another illustration of the fact that no matter how well protected is the superstructure or how efficient the fire department, a heavy loss may be expected whenever fire reaches the combustible, inaccessible space under the pier deck.

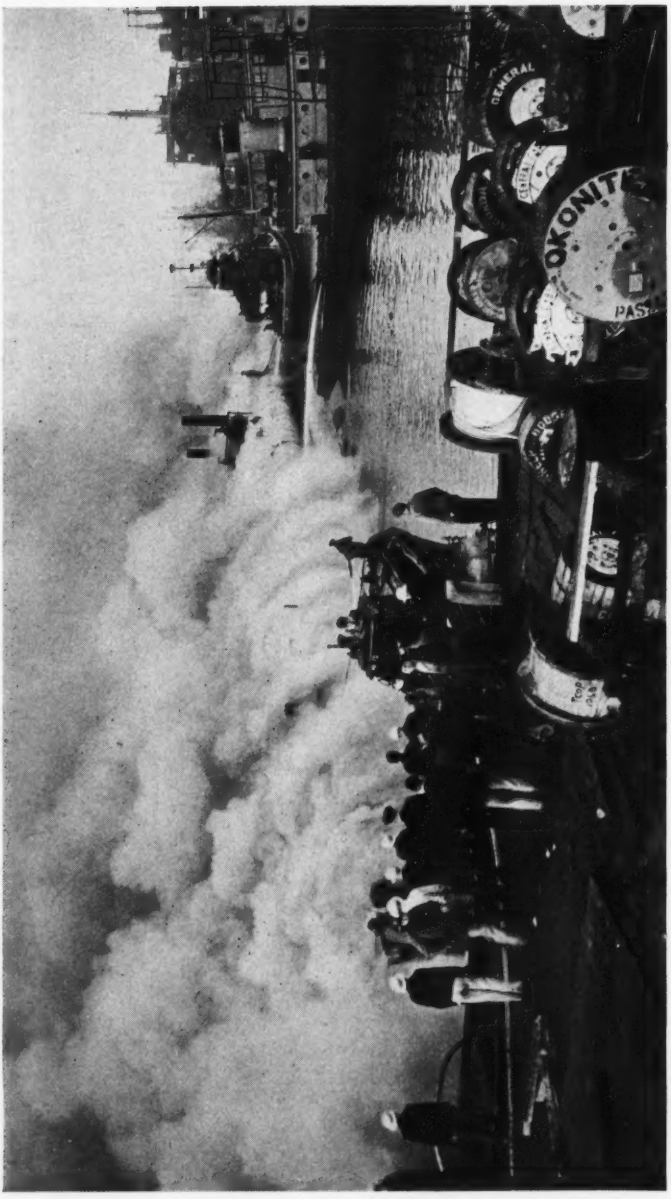


Press Association.

Fire, starting on a gasoline lift truck in a frame wharf shed at Port Edward, Ont., July 17, 1945, destroyed the wharf and the S.S. "Hamonic," with a total loss of $3,000,000.

Milton Werschkul.

Oregon Shipbuilding Corp. fire, August 30, 1945. Part of wharf, total length 2200 ft., at height of fire. Fire spread from wharf to shops on landward edge of wharf. Fireboat in center, harbor patrol boat to the left. Four of five $75,000 cranes, two shown in photo, toppled when burning piling collapsed. Loss estimated at $3,000,000.



International News.

Ship repair pier, 1229 ft. long, burning at Long Beach, Calif., Dec. 5, with an estimated loss of $1,000,000. Fire in the inaccessible space under the pier could not be reached. There were neither fire walls nor automatic sprinklers.

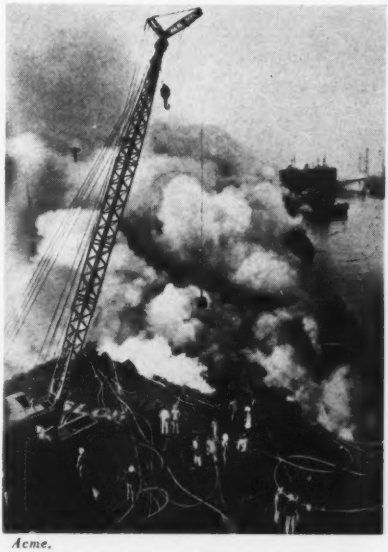
were still in their staterooms. The intense heat from the pier ignited the ship's superstructure. Escape was accomplished only after the mooring lines were cast off and the ship moved to an adjoining coal wharf. Many passengers were removed by a large clam shell bucket ordinarily used for handling coal. A hundred persons were injured. (See October, 1945, QUARTERLY, pages 100-103.)

Aug. 30, near Portland, Ore. Shipyard. $3,000,000.

Lack of automatic sprinkler protection or transverse fire walls for the under deck space of an outfitting wharf at the Oregon Shipbuilding Yard were principal factors in the destruction of the wharf and combustible shipyard shop buildings. The wharf deck was not protected against the passage of sparks from a welder's electrode, which ignited an excessive amount of oil-soaked combustibles on the surface of the stagnant water beneath the wharf. Wind direction was favorable to the rapid spread of the fire from the wharf to the shop buildings built on the landward edge of the wharf. Shipyard, Coast Guard and City firemen fought the fire, which might have engulfed the entire shipyard but for their successful efforts in preventing the spread of fire to a large machine shop and eleven shipways. (See October, 1945, QUARTERLY, page 115.)

Dec. 5, Long Beach, Calif. Ship Repair Pier. $1,000,000.

This pier, owned by the city of Long Beach, was leased to the Consolidated Steel Corp. and the U. S. Maritime Commission for ship repair operations. Fire started beneath the pier in the vicinity of two portable gas boilers fed by a two-inch gas line running underneath the pier. A workman telephoned an alarm at 10:54 P.M., calling out a large fire fighting force, including three fire boats, two fire tugs, a dozen fire companies and an industrial fire brigade. The pier on which the fire occurred was 1229 ft. long and 67 ft. wide and comprised an area of nearly two acres. It was of heavy timber construction, covered with 4 inches of black top surface. Access to the underpier space was blocked by four ships tied up for repairs, an unusually high tide, and lack of fire walls or draft curtains permitted fire to spread under the entire area of the pier among the creosoted piling. Tugs to move the ships were not available for two hours. An oil spill from a marine oil terminal sixteen hours previous to the fire also contributed to the spread of the flames, according to a fire department report. In addition to streams from fire boats, some twenty hose streams were used, including cellar pipes and distributor nozzles used through holes in the pier deck and straight streams from barges. Fifteen firemen were treated for smoke and exhaustion and a battalion chief was injured when he fell through the dock. Damage to the pier was placed at $750,000, with additional loss to ships and equipment on the pier unreported, but probably bringing the total loss to $1,000,000. Final control was not secured until 4 P.M. December 7th.



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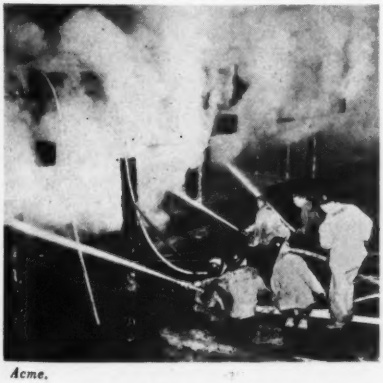
A weight dropped by a crane was used to break holes in the pier deck.



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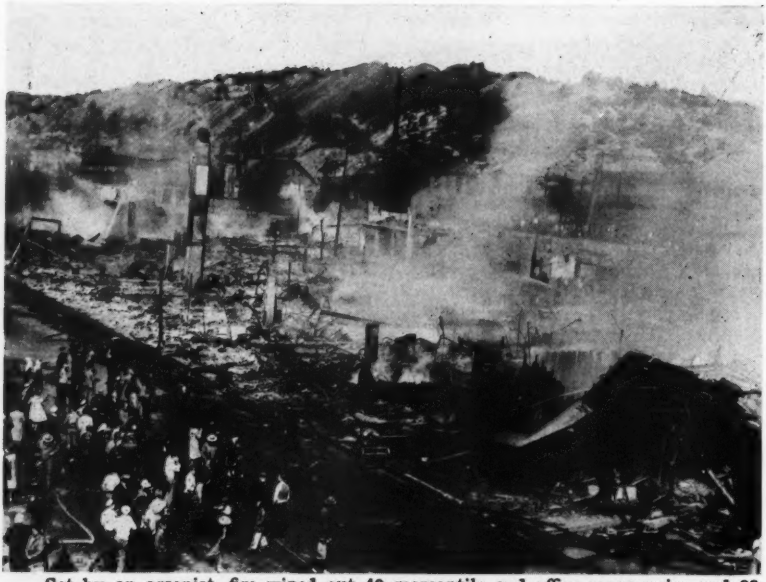
Firemen on a barge fighting the Long Beach pier fire.



Set by an arsonist, fire wiped out 40 mercantile and office occupancies and 38 apartments in this congested, frame-building business area in Mahanoy City, Pa., on May 30.

Conflagrations.

May 30, Mahanoy City, Pa. Conflagration. $1,000,000.

Absence of a satisfactory building ordinance, which would have prohibited the congestion of frame construction without a single fire break in a block area of 30,000 sq. ft., was largely responsible for the conflagration proportions of this arson fire. A 45-year-old, odd-job man, now sentenced on 16 indictments totaling 70 to 140 years in the Penitentiary, confessed gathering oily waste from a journal box of a railroad car and setting a fire in a small garage in the congested frame area. Fanned by a wind up to 50 m.p.h., the fire, starting at 3:10 A.M., destroyed thirty business buildings, four dwellings and several garages and considerably damaged fifteen other buildings. Forty mercantile and office occupancies and thirty-eight apartments were wiped out by the conflagration. A strong water supply, providing constant supplies to 14 utilized hydrants, helped save the rest of the neighborhood, as five local fire companies and three OCD auxiliary units, plus pumpers from six other towns, fought the flames for four tragic hours. Water curtains were successful in several instances, even where frame construction was involved, despite the wind and many evidences of high heat intensity. There were many injuries from burns and falling walls, but no fatalities.

Oct. 24, Los Angeles County, Calif. Conflagration. $300,000.

Legal restrictions prevented the response of Los Angeles County Fire Department forces to a serious fire in a "no-man's land" between the cities of Vernon and Huntington Park. The strip of property, valued locally at $2,000,000, lacked any public fire protection, and the owners had refused (despite previous fires) to pay a $400 yearly assessment for fire defense. Largely consisting of an automobile junk service, and sales buildings, the blaze is attributed to ignition of the tar paper and wood roof of the California Frame and Axle Company from a burning rubbish pile. Flames subsequently were spread by high winds and destroyed six other buildings and approximately 150 automobiles. Huntington Park and Vernon Fire Departments stood by to protect their "districts" and the former crossed the line as the flames endangered their property owners. The fire had gained such headway by that time that twenty men worked eight hours to knock down flames.

Recreation Buildings.

Jan. 4, Chicago, Ill. Bowling Alleys. $250,000.

A porter discovered smoke coming from the exhaust ducts near the air conditioning equipment in the Lawrence Bowl bowling alley and gave the alarm at 5:52 A.M. Fire of unknown origin destroyed this large establishment containing restaurant and bar facilities. Except for a stove in the pin boys' room, the building was unheated at the time fire was discovered. Formerly a garage, the building had brick walls, one-inch boards on wood truss roof, with a ground area of 30,000 square feet. A suspended wire lath and plaster ceiling formed a concealed attic space without draft stops or automatic alarm or sprinkler protection which contained the air conditioning fan unit and metal ducts. When heated, the metal ducts, supported by the lower chord of the wood trusses, helped to spread the fire throughout the large open unprotected attic space. Improper arrangement of pin storage and refinishing, as well as storage of a large supply of shellac, lacquer and thinner in ordinary five-gallon cans and fifty-gallon drums, was apparently not the direct cause of the fire.

Jan. 15, Sampson, N. Y. Naval Recreation Building. $300,000.

An early morning fire of undetermined origin destroyed the Ship's Service Building in the Dewey Unit at the U. S. Naval Training Center. This building housed a cafeteria, stores, bowling alleys, recreation equipment and a library. The fire was fought by the post fire brigade. No other information has been released.

Feb. 22, Jefferson Parish, La. Gambling Establishment. $500,000.

Fire starting at 1:25 A.M. in an old storage room destroyed a pretentious gambling establishment outside of New Orleans. The one-story stucco building was of modernistic design, with elaborate furnishings and gambling equipment. The fire spread slowly throughout the building, but the Parish fire department

Chicago Daily News.

This twisted mass was all that remained of the Lawrence Bowling Alleys in Chicago, following a fire on January 4. A large concealed attic space, housing ventilating equipment, contributed to the spread of this fire.

This Portland, Oregon, plant producing prefabricated timber trusses and other parts was the largest of its kind in the Northwest prior to the fire of Oct. 1. A guard stated that the fire originated where high voltage wires entered the building. Before he could reach an alarm box, the entire wooden roof was in flames.

and three city fire companies who responded were hampered by limited water supplies. While employees saved a portion of the gambling equipment, elaborate furnishings, draperies and rugs were destroyed.

July 2, Deep Brook, Nova Scotia. Naval Recreational Center. $307,000.

Fire, discovered at 2:15 A.M., totally destroyed the H. M. C. Physical and Recreational Training School building as fire fighters were forced to concentrate on preventing extension to neighboring buildings. Originating on the inside frame walls, the only theory as to cause appears to be that an electric hotplate had been left "on." The frame building, 200 x 80 ft. and between 50 and 60 ft. high, contained two swimming pools, a gymnasium and locker room used by the R. C. N. Twelve hose lines were put in service by the Navy Fire Department, but the flames had such headway that the building was totally destroyed.

Sawmills, Lumber Yards, etc.

April 6, Pemberton, N. J. Lumber and Millworking. $338,000.

Although this plant was in operation producing prefabricated dwellings and men were working at the spot where the fire originated, positive information on the cause is unknown. Dust conditions from the sawing of highly combustible wall board in the cutting room make plausible the possibility that a flash fire resulted from a mild dust explosion. The saw was claimed to have been equipped with a blower and duct system. The large (96,000 sq. ft.) undivided, one-story frame building, with combustible stock and contents, was totally involved within 15 minutes. Dressed lumber in a storage yard and ten freight cars were also destroyed. Explosions of barrels of creosote in the building caused the fire to extend to a feed and lumber mill and a garage, which exposed the plant on two sides. The water supply from a near-by stream, a single hydrant on a 4-inch main at 500 feet and a creek one-half mile distant was inadequate, hampering the fire fighting. Seven engine companies from neighboring towns and villages answered a telephone alarm.

April 11, Chicago, Ill. Lumber Yard and Mill. $698,200.

A lumber and mill working plant area 700 by 250 ft. was destroyed by fire apparently caused by spontaneous ignition of bagged sawdust. The loss involved the Red River Lumber Company and adjoining properties and required response by some 60 pieces of fire equipment. Interest in the fire centers around the fact that the greatest portion of the area was protected by automatic sprinklers, but gale winds and the quick burning quality of the woodworking occupancy and construction resulted in the blaze going beyond sprinkler control. (See July, 1945, QUARTERLY, pages 60-63.)

May 26, Waters, Miss. Box Factory. $537,000.

A fire of unknown origin started in the end of a 61,000 sq. ft. iron-clad dimension mill and flooring mill building, and gained considerable headway before the chief guard called the Vicksburg Fire Department, two and a half miles distant, at 5:45 P.M. Before the alarm was given, three watchmen of the Anderson-Tully Company spent 15 minutes in an unsuccessful attempt to extinguish the flames near a lumber lift and refuse conveyor. The water supply system consisted of an 8-inch main connected to the city distribution system and a private 20,000-gal. tank elevated only 50 ft. Evidence indicates that a valve in the public water supply was partially closed. Upon arrival of the fire department, the sprinklers were operating ineffectively, and when three hose lines from a 1250-gal. pumper were connected to a hydrant, the water supply failed because of depletion of the 20,000-gal. tank. Subsequently, water was obtained from a near-by pond. Loss to the mill building, cooling shed, dry kilns and loading dock was total, while considerable damage was sustained by the box factory, electric power plant, boiler house and ten box cars on sidings. Firemen prevented spread of fire to the sawmill, lumber yard and other minor buildings, bringing the flames under control at 12:30 A.M. The plant had been closed for about one hour when the fire was discovered.

July 7, Sonora, Calif. Sawmill. $765,000.

The huge Pickering Sawmill at this location was destroyed by fire originating in the resaw section of the one-story, 45 ft. high, unsprinklered frame building. Supposition is that a hot box of a resaw ignited dry sawdust, which quickly spread fire throughout the structure and drove employees from the mill just as the shift changed at 5 P.M. Oil soaked floors, pitch and

Fifty-thousand cord pulpwood pile burning at East Angus, Que., October 21.

Red River Lumber Co. fire, Chicago, April 11. Loss $698,200.

lumber scraps fed the flames, creating serious exposures to neighboring buildings. Dry weather conditions further complicated fire fighting. Grass ignited, resulting in the death of a staked cow, and damaged an automobile parked 500 ft. from the mill. A detached brick power plant was also damaged. Company and state firemen fought the fire with all resources at their command, which included yard hydrant water system and mill pond.

Aug. 9, Spokane, Wash. Sawmill. $350,000.

A fire in the sprinklered sawmill of the McGoldrick Lumber Company got a good start under an unprotected loading platform thirty minutes after closing time. Discovered by a watchman, an attempt to knock the flames down by use of a standpipe hose failed, and the entire building, two stories in height, became involved. Because of the quick burning nature of the construction and contents, the flames opened over 850 heads and the extensive sprinkler system failed to control the fire. This system was designed to control fire originating in the sprinklered area; sprinkler systems as ordinarily installed cannot be expected to control fires which reach major proportion in unprotected areas and spread to sprinklered areas. Yard hydrants (on the same water supply system as the sprinklers) gave only dribbles when attempts were made by the fire department to connect hose lines to the system. Twelve engine companies responded to the 5:03 P.M. alarm as called for by radio from the chief on his way to the scene, and all efforts were concentrated on saving exposed buildings and lumber stocks. The sawmill, boiler and pump house, plus employees' club house and superintendent's office, were completely burned. Originally constructed in 1907, the plant has suffered 11 fires, with previous losses totalling about $380,000, including a $30,000 fire the previous day in the planing mill.

Aug. 22, Willits, Calif. Sawmill. $400,000.

The Sage Land and Lumber Company sawmill was destroyed by fire when an overheated bearing of an edger threw off sparks and ignited sawdust in the vicinity. A large flywheel on the same power line acted as a fan to scatter burning sawdust over a wide area of the mill in a matter of seconds. Starting at 11:45 A.M. the flames drove 42 employees from the building, all except one of whom escaped without injury despite "walls of flame." The mill, 2½ stories of substantial frame construction, was 28,400 sq. ft. in floor area and was a serious exposure hazard to a boiler house and chain shed (destroyed), a redwood log pile (partially destroyed), office, shop, garage, oil and file buildings (saved), and 800,000 ft. of lumber in the yard (also saved). Volunteer

Fifty-thousand cord pulpwood pile burning at East Angus, Que., October 21.

fire fighters were aided by State Forestry Division crews and did a creditable job of limiting the spread of flames despite weak private and public water supplies. The small forestry trucks, equipped with water tanks, proved invaluable in preventing fires in near-by residential areas of the town.

Sept. 14, Rimouski, Quebec, Can. Lumber Yard. $500,000.

Fire of unreported origin destroyed the planing mill and machinery of the La Perelle Lumber Company, spreading to fifteen freight cars loaded with lumber and to four residences. Starting about 5:00 P.M., the flames rapidly devoured the highly combustible buildings, made homeless ten families and left unemployed some 100 persons. The absence of a wind is credited with saving the rest of the town. Fire fighters of Rimouski, a near-by military camp and the Aviation School at Mont-Joli battled the flames, but were hampered by the bursting of a hose line.

Oct. 1, Portland, Ore. Prefabricated Timber Products. $500,000.

An area of over five acres was involved in the Timber Structures, Inc., fire which started in the glue department of the laminating plant and spread to the box factory, planing mill and storage sheds. Approximately one million feet of lumber stored on the property was also lost. Apparently a long delay occurred in transmittal of the alarm, as flames were observed by a fire station two miles away before any alarm was received. The guard who reported the fire at 7:30 P.M. states that he was leaving the planing shed when a flash occurred in the vicinity where high voltage wires entered the building and that before he reached an alarm box the entire roof of the glue room was in flames. The company had been making wood roof trusses, arches and columns during the war and has a yearly production of more than eighty million board feet of prefabricated lumber. A Federal Housing Project was threatened by the flames, but escaped damage as the result of fire fighting methods employed and the efforts of owners to wet down the exposed roofs and walls with garden hose.

Oct. 21, East Angus, Quebec, Can. Pulpwood Pile. $350,000.

Fire, originating in the motor house of a stacker, spread to a mammoth pile of spruce logs and burned from 11:35 A.M. Sunday until late Tuesday before 125 fire fighters and 75 soldiers could bring it under control. The piling area, estimated to contain between 50,000 and 55,000 cords at the time of the fire, was about 750 feet long and 250 feet wide, with a crest varying from 70 to 90 feet. To protect this pulpwood supply of the Brompton Pulp

The McGoldrick Lumber Co. sawmill, Spokane, Wash., burned on August 9. Fire started under an unsprinklered loading platform and reached such proportions that sprinklers, designed only to control fire starting in the sprinklered area, were not effective.

and Paper Company, there was only one public hydrant available (500 ft. away) on a six-inch line from the eight-inch town supply system. Three lines were laid from the single hydrant by noon on Sunday and another was placed in service by 12:30 to give a total estimated discharge of 500 g.p.m. delivered at the fire. Outside aid was quickly requested and throughout the afternoon, evening and following day, pumpers, hose, manpower and deluge sets arrived from Sherbrooke and a dozen other communities and industries within a sixty-mile radius ultimately to permit the use of twenty-five hose streams, including six deluge sets. The large loss was directly attributed to the excessive size of the piling area subject to a single fire and to the absence of fire fighting facilities to compare with the hazards. Salvage efforts continued throughout the fire, but only approximately 12,000 cords could be saved by fire fighting and manual separation of the stock.

Truck Terminals.

Feb. 11, Billings, Mont. Truck Lines Terminal. $283,000.

Fire of undetermined origin destroyed the Consolidated Motor Freight Lines terminal. The one-story frame and stucco garage housed office records, trucks, truck parts, cargo, oil and equipment. The watchman, who was unsupervised, was late on his hourly rounds, and the fire was discovered by a taxi driver. It had burned through the roof when firemen arrived, and exploding fuel barrels and truck gas tanks contributed to the rapid spread of fire throughout the wood structure. Ten hose streams were used to protect exposures.

Nov. 7, San Francisco, Calif. Truck Terminal. $500,000.

When flames were observed by passing civilians at 10:40 P.M. they extended through the roof of the one-story frame Oregon, Nevada and California Fast Freight Line Terminal. Response by 27 engine companies, 6 hose and 9 ladder companies was required to bring the fire under control and to protect exposures. The adjoining Coast Pipe and Supply Company plant was involved quickly, but a five-story concrete building housing the Navy Fleet Post Office was saved. Eighteen diesel trucks and trailers stored in the Terminal Yards were

When this fire in an Erie, Pa., trucking concern was reported at 6:26 a.m., Dec. 6, most of the downtown fire companies were fighting another fire. Cause: sparks from welding.

Fiber board interior finish was used and sprinklers removed when the Portland, Maine, Armory Annex was converted from a car barn. Occupied by three separate government agencies, no one had control over maintenance of the building, and the Portland fire department had no jurisdiction. Fire started in a wooden trash box on Feb. 24. One fireman was killed when a wall blew out.

damaged beyond repair. A quantity of sulphur awaiting shipment hampered fire fighting operations. None of the buildings destroyed had automatic sprinklers, but the wired glass windows in the Navy Post Office were cited by the Fire Department as being of great assistance in preventing the spread of fire to that building. Adequate water was available for 23 hose lines from both low and high pressure mains in the area.

Dec. 6, Erie, Pa. Truck Terminal and Warehouse. $400,000.

Fire quickly spread through a garage building, despite attempts of employees to use extinguishers, after an electric welder (being used to repair a truck) ignited grease. Newspaper reports state that the fire had already involved an adjacent warehouse when firemen responded to a 6:26 A.M. alarm. Large quantities of freight, said to include automobile tires, new refrigerators and stoves, tons of butter, meat and Christmas candy, plus many miscellaneous grocery items, added fuel to the fire. Additional impetus was provided by explosions of drums of oil in the garage. The buildings, owned by the Lyons Transportation Company, were adjacent to dwellings and a service station which were endangered, but only one private garage was involved and this fire was quickly extinguished. Employees of the trucking concern were able to save twenty tractors and trucks, but several vehicles were consumed as flames blocked attempts to move them from their parking area.

Miscellaneous Public Buildings.

Jan. 2, Malaga, N. J. Dinshah Spectro-Chrome Institute. $296,828.

The main building of the Institute, one of eight on a 23-acre site, was a 30-room, 2½-story, frame structure, located in a section without public water mains. It was used as an administration building and contained auditorium, school, research laboratory, offices and health services "developing a theory of therapy by color rays for healing disease." A high wind spread the fire in the building rapidly, and in 90 minutes the main building, including considerable electrical equipment and other contents, was totally destroyed. A portion of the Institute records, kept in a safe, were recovered with practically no loss. Origin of the fire, which was discovered at 11:30 A.M., is unknown. Five volunteer fire companies with seven pieces of apparatus responded promptly to telephone and radio alarms. Water from fire apparatus booster tanks was successfully used to prevent fire spread to seven near-by frame buildings.

Feb. 24, Portland, Me. Armory Annex. $250,000.

Fire occurred in a rebuilt two-story brick addition to the Armory structure, formerly used as a street car barn. Interior partitions in the rebuilt structure were highly combustible wall board on wood studs. The building housed the State Guard on the first floor and U. S. Army Induction Center and U. S. Army Intelligence Division on the second floor. An alarm was given at 2:10 A.M. by a passer-by, who ran 800 feet to a street alarm box. Flames were through the roof when fire companies responded from a station only 500 feet distant. During the fire an explosion in the second floor collapsed a section of a brick wall, killing one fireman and injuring two others. Fire apparently started in wooden waste boxes in a second floor corridor which contained tissue paper, cardboard boxes and cigarette butts. The wood containers had replaced covered metal cans which were not considered large enough. No one of the three military occupancies in the building was responsible for protection of the building. There were separate janitors for the first and second floors and whenever classes or drills were finished, the last person to leave turned off the lights. The building could not be secured, as the front door lock had been broken for three weeks. There was no guard, no watchman, no sprinkler system, no automatic alarm service, and due to the occupancy of the building the local fire department had no fire prevention jurisdiction. During the fire, there were frequent explosions of small arms ammunition. Firemen succeeded in saving the drill shed and motor vehicle storage sections, which were fairly well cut off from the two-story section where the fire started.

Occupied by three separate government agencies, no one had control over maintenance of the building, and the Portland fire department had no jurisdiction. Fire started in a wooden trash box on Feb. 24. One fireman was killed when a wall blew out.

Mar. 4, Fort Riley, Kans. Administration Building. $270,000.

A three-story administration building with masonry walls, wood-joisted floors and slate roof construction was partially destroyed by fire. Fire is believed to have started in hallway or ladies' rest room on the first floor, cause unknown. Post fire department controlled the fire in the roof, fought it back to point of origin and confined heavy damage to second floor and roof.

June 22, Philadelphia, Pa. Shrine Temple. $300,000.

A highly spectacular fire destroyed the unsprinklered, four-story brick-joisted LuLu Temple, Philadelphia headquarters for the Ancient Arabic Order of the Mystic Shrine. Five alarms, bringing 19 engine companies to the scene, were required. The ornate structure, built in 1904, mounted a huge Moorish copper dome, flanked by four minarets of similar design. Flames swept upward to the large dome from the interior, causing its collapse within half an hour after the fire was discovered by a Shrine official. Fire fighters wet down roofs in the vicinity, as flaming embers fell over a wide area. It is believed that the cause was a short circuit in the switch box of the auditorium, which ignited stage equipment. The alarm of fire was slightly delayed as six Shriners attempted unsuccessfully to extinguish the flames with first aid appliances before calling the fire department.

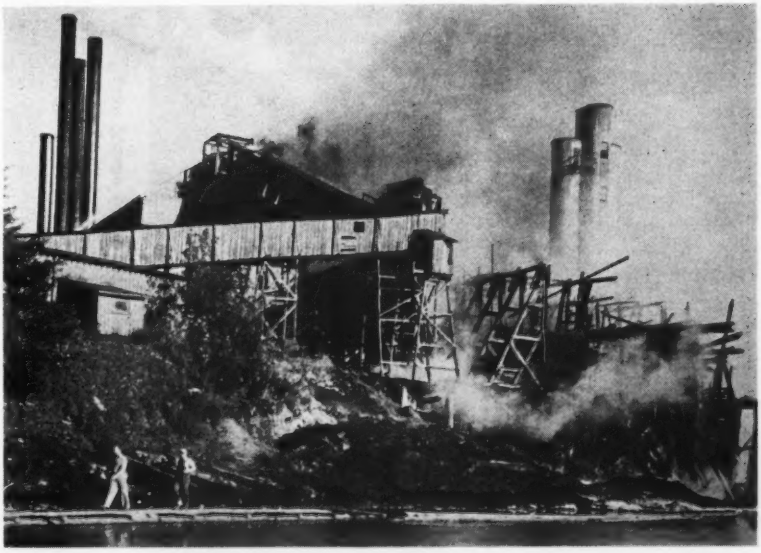
Pulp and Paper Mills.

Aug. 19, Salem, Ore. Paper Mill. $350,000.

Two dry pipe, automatic sprinkler systems in the woodmill and lime rock sections of the Oregon Pulp and Paper Company were so arranged that a fire originating in the immediate vicinity caused both valves to open almost simultaneously. The fire is believed to have been caused by ignition of combustible materials below the floor of the one-story and basement, woodmill section while workmen were operating welding equipment. Employees testified that flames appeared with an explosive report at 4:30 P.M. and spread rapidly through several unprotected floor openings, quickly involving the roof of the one-story and basement frame building. The workmen were driven from the area, and one called the fire department. There is evidence by witnesses that there was almost immediate operation of the dry pipe sprinkler equipment, but that the fire was too extensive for the sprinklers to hold it. It was impossible to employ an inside standpipe (with hose connected), which the employees had used twice during the day to extinguish two small fires and to wet down the area where welding repairs on a conveyor were being completed. The water supply for this plant was a good two-source, circulating system, with 6, 8, and 10-inch mains fed from the city water supply and from two steam fire pumps, with a combined capacity of 2250 g.p.m. taking suction from a 100,000-gallon storage tank. The fire department had hose streams from three 1000 g.p.m. pumps directed on the fire in 15 minutes, but the fire had spread to the lime rock shed, fuel vault and the five-story digester building. The fire department pumps placed a heavy demand on the already taxed sprinkler system. A temporary connection was hastily arranged to enable the use of one of the plant's 5000 g.p.m. centrifugal service pumps at 6:30, which discharged 2500 to 3000 g.p.m. into the plant's fire mains at 100 lbs. pressure. This improved the sprinklers' discharge rate in the digester building at a time when the situation was most critical. In all, the fire destroyed the woodmill, two exposed structures and caused very heavy damage to the digester building. At least five separate sprinkler systems operated in the buildings destroyed. There is no information available as to the contents of the basement in which the fire originated. Humidity on the day of the fire was reported to have been 19 to 20 per cent, which may have contributed to the flash fire which occurred. Demands on the water supply were, of course, exceedingly heavy. It is considered a strong possibility that the fire created an immediate 2000 g.p.m. demand, resulting in insufficient volume and pressure at individual heads. A flow test several days after the fire showed a discharge of only 1750 g.p.m. at five

International News.

Virtual destruction of the Shriners Temple in Philadelphia resulted from this spectacular fire on June 22.



Salem, Ore., pulp and paper mill fire, Aug. 19.

pounds pressure on the same system, indicating a possibility of an obstruction in the sprinkler mains. This feature could not be checked definitely because of removal of the line while cleaning up debris following this large loss fire. Considerable investigation has been made by responsible authorities, and it is believed that the exact cause or causes for the failure of the sprinkler system to control this fire cannot be obtained.

Sept. 14, Vancouver, B. C., Can. Printing and Envelope Manufacturers. $337,000.

Delayed discovery and absence of automatic sprinkler or alarm service gave a fire in the Smith, Davidson, Wright plant a fatal head start. The four-story brick, heavy-joisted building was completely gutted, and three firemen lost their lives as weakened and overloaded floors collapsed and trapped them in the building. Occupied as a printing and envelope manufacturing establishment, heavy printing machinery and water-soaked paper storage were blamed for the early collapse of the floors. Fire apparently started on the second and third floors and traveled through an open elevator shaft and stairs to other portions of the building. A passer-by subconsciously noticed smoke, but failed to report it until seventeen minutes later (6:38 A.M.) when it occurred to her that there might be something wrong. The smoke from the fire was so intense that it greatly hampered fire fighting, and thirty-three men were treated for excessive smoke inhalation and exertion.

Textile Manufacturing.

April 10, Springfield, Mo. Clothing Manufacturing. $291,000.

Absence of watchman service and automatic sprinklers allowed an early morning (1:25 A.M.) fire in the factory of the E. S. Lurie Manufacturing Company to gain great headway before discovery by a tenant of an adjoining hotel. The old, three-story brick building, with ordinary wood floors and tar and gravel roofs on ordinary joists and boards, was being used to produce army trousers. One report states that 2000 finished trousers and enough material for 100,000 were destroyed. The cause was unknown, but apparently the fire started in the basement and spread through unprotected floor openings. A gas fired steam boiler might have been the origin, but total destruction of building and contents prevented accurate analysis.

Press Association.

This forest fire in Tillamook County, Oregon, was one of a series of fires during the summer of 1945 which burned some 200,000 acres of Oregon timberland. Forest fire losses are reported in acres rather than in dollars, and so are not usually included in national fire loss statistics. The direct and indirect losses in this series of fires, however, may well exceed $100,000,000. A considerable part of the area of the 1933 fires was again burned, destroying the results of 12 years of extensive reforestation and permanently impairing the productivity of the forest soil.

Forest Fires.

July 6, Tillamook County, Ore. Forest Fire. $1,000,000.

Some 125,000 acres of forest land were burned in Tillamook County in a fire which started as two separate fires, merging into one. The fire started on July 6 and burned for nearly two months. During part of the time, more than two thousand men were engaged in fire fighting. The area burned was largely that destroyed in the forest conflagration of 1933 (QUARTERLY, January, 1934, page 198). The results of twelve years of reforestation were lost and soil humus was consumed, with a serious impairment of the fertility of the soil. The loss figure of $1,000,000 is purely nominal, however, and the ultimate losses may be much greater. Forest fire losses are usually reported in acres rather than dollars, and there are no detailed loss estimates of the dollar value of the forest area loss. Logging equipment to the value of $91,000 was lost by one lumber company. The cost of fire fighting operations was at least several hundred thousand dollars.

Sept. 18, Humboldt County, Calif. $647,225.

Starting from careless smoking, this fire burned 18,020 acres before it was finally brought under control on October 8. The Hammond Lumber Co., owner of most of the burned area, had a fire crew of 300 men at the fire within an hour of its discovery at 3 P.M. One man was trapped and killed. A total of 26,228 man hours was spent in suppressing and patrolling this fire. Losses reported by De Witt Nelson, California State Forester, were: Merchantable timber, $3750, young growth damage, $23,000, and improvements, including logging equipment, camps, sawlogs, etc., $620,473. Dwellings and auto courts along a main highway were saved by state forest fire trucks.

Sept. 28, San Diego County, Calif. Forest Fire. $890,530.

Fire started by an engine burned 44,470 acres in San Diego County, according to a report by California State Division of Forestry. The major part of the loss was forage.

The 1945 Fire Loss.

The following preliminary estimate of the United States fire loss for 1943, 1944, and 1945 has been released by the National Board of Fire Underwriters. These figures, based upon insurance losses, with a fixed percentage of allowance for uninsured and unreported losses, do not reflect the increased contribution to the national fire loss made by fires in uninsured government-owned properties. Such losses are not currently reported through any central agency, but it appears clear from the fragmentary information that is available, if these uninsured government losses were included the fire loss curve would show a still more pronounced upward trend.

	1943	1944	1945
January	$27,733,000	$38,572,000	$44,865,000
February	33,175,000	38,280,000	41,457,000
March	39,214,000	39,084,000	40,876,000
April	34,241,000	34,746,000	37,950,000
May	29,297,000	32,815,000	34,153,000
June	26,854,000	30,505,000	34,090,000
July	25,016,000	32,706,000	34,054,000
August	29,193,000	30,618,000	34,096,000
September	26,488,000	31,418,000	32,447,000
October	29,661,000	32,173,000	34,470,000
November	31,647,000	33,847,000	37,393,000
December	47,716,000	48,694,000	49,478,000
Total 12 months	$380,235,000	$423,458,000	$455,329,000*
Adjusted loss figures	$373,000,000	$437,273,000	

*The adjusted loss figures, not available until about the middle of the year, may be expected to vary from the preliminary estimates.

Hartford Christmas Tree Tragedy.

A short circuit in homemade electrical wiring, resulting in ignition of combustible decorations around a Christmas tree in the Niles Street Convalescent Hospital in Hartford, Conn., on December 24, 1945, was responsible for a fire which caused the death of 17 patients and 2 attendants and injury to nearly 30 others, including 10 firemen.

The Building.

The building, over 60 years old, was originally a duplex dwelling and had been converted for hospital use. It was three stories high, of ordinary construction, with brick walls and wooden interior. A brick division wall in the center ended at the third floor ceiling, leaving a large open space with no fire stops under the flat, metal-covered roof. There was a passageway on each floor through the division wall.

Two wooden stairways at the front of the building led directly outside, and rear exits on each floor led to a large wooden verandah, with wooden stairs to the ground. There were no outside fire escapes.

Soda-acid and water pump tank extinguishers were located on each floor of the hospital and in the cellar. There was no private fire alarm system in the building, but a municipal fire alarm box was located within 75 feet of the main entrance. No automatic sprinkler protection was provided.

Story of the Fire.

The fire originated in an office on the first floor when an attendant attempted to disconnect the lights of a Christmas tree. A spark occurred, presumably due to defective wiring, which immediately ignited flammable cotton at the base of the tree. Another attendant attempted to use a near-by telephone, but the fire had spread so rapidly that the wires had burned out, rendering the telephone useless. In the meantime the first attendant attempted to use an extinguisher, but apparently did not operate it correctly, became panicky and

Charred stairway located near room of origin of fire. Fire spread rapidly up this stairway to upper floors, where most of the elderly, bedridden patients were sleeping.

rushed from the room, leaving the door open. This provided a draft to fan the flames. A few minutes later (approximately 9:02 P.M.), simultaneous telephone and box alarms were given by a next door neighbor and a passer-by. Non-fire-stopped walls and ceilings and open stairways contributed to the rapid spread of the fire. Approximately three-quarters of the Hartford Fire Department responded on three alarms and the fire burned until midnight. While the fire department did an effective fire fighting job, they were unable to extinguish the rapidly spreading fire before the building had been completely gutted. This fire caused a loss of $41,000. Most of the fatalities were elderly, bed-ridden patients, who were either burned to death or suffocated before firemen could reach them.

Conclusions.

1. This fire again calls attention to the extreme hazard of the use of flammable decorations on Christmas trees. Non-combustible materials for such purposes are available and should be used.

2. Only standard electrical equipment should be used, and this should be properly maintained. Some publicity was given in this fire to the fact that the electric lighting set on the Christmas tree had been made by an elderly inmate of the hospital.

3. Employees in hospitals, institutions and similar occupancies where numbers of people are housed should be instructed and trained in the proper use of fire extinguishers.

4. The extreme hazard of open stairs, particularly in quick-burning, unsprinklered buildings, is tragically demonstrated in this fire. If the stairs in this building had been properly enclosed, it is believed that this large loss of life would have been avoided.

Navy Firemen's Training.

Over one hundred N.F.P.A. members and guests of the N.F.P.A. Committee on Firemen's Training attended a two-day demonstration of war developments in Navy fire training techniques at the New York Navy Yard Fire Fighters School on October 30 and 31, 1945. This first post-war demonstration, arranged by Captain Harold J. Burke, U.S.N.R., Director of Fire Damage Control work for the U. S. Navy in Washington, was under the direction of Lt. Commander W. J. Magner, Commanding Officer in charge of the New York Navy Yard Fire School, and Lt. Commander Charles McKeogh, U.S.N.R., Executive Officer. The purpose of the demonstration was to enable the members of the Firemen's Training Committee and their guests to observe the Navy techniques and to consider their postwar usefulness in firemen's training. The success of the Navy in a training program involving approximately two and three-fourths million Navy men during the war period has been widely publicized, but the methods and equipment used had been hitherto generally restricted to those directly connected with the war effort.

The program was devised to enable those attending to witness Navy training films, equipment, and other training aids, as well as to show the effectiveness of actual fire fighting in simulated ship sections in training novice personnel.

A.D.T. Photo.

Members of the N.F.P.A. Firemen's Training Committee present were: Chief Harry K. Rogers, Western Actuarial Bureau, Chicago; Lt. Commander W. J. Magner, USNR, commanding officer, New York Navy Yard Fire School; Chief J. F. MacMillan, Cocoa, Florida; W. A. Ross, U. S. Office of Education, Chairman, Committee on Firemen's Training; Robert Hamm, Indiana Fire Service Training School; Commander Harold J. Burke, USNR, Director, Fire Damage Control for U. S. Navy; and Fred W. Shepperd, Fire Engineering magazine. Also present but not in the picture were Chief J. W. Just, Vice Chairman, Fire Service Extension, University of Maryland; and W. J. Scott, K.C., Fire Marshal, Province of Ontario.

U. S. Navy Photo.

Demonstration of extinguishment of fire in simulated ship sections.

Navy Fire Equipment.

Cutaway models of the Navy P-500 pump, the Handy-Billy pump, the Pressure Proportioner foam equipment, the Navy "pick-up" nozzle, the Navy "all-purpose" nozzle, and the Navy "Rescue Breathing" apparatus were available for inspection, and instructors, returned from active fire fighting in war theatres, demonstrated the equipment. Following the preliminary study of the cutaway equipment, demonstrations were given by Navy fire fighting teams in the structures and outdoor equipment using the apparatus to extinguish fires.

Navy Training Films.

All security restrictions have been removed from the Navy training films. *Chemistry of Fire* is believed to be one of the finest training films ever produced. Members of the Firemen's Training Committee believe that it will prove to be of considerable value in the training of novice firemen and others in the post-war period. While the film contains considerable reference to fire fighting in ships, the rudiments of the chemistry of fire are so well portrayed that direct application of the principles to civilian fire fighting problems can be made. Prints of this film are not expensive.

School of the Fire Fighter applies principally to shipboard fire fighting, though certain sections of the film might be found useful in connection with training of novice personnel in handling fire hose.

Rescue Breathing Apparatus demonstrates the use of the equipment and is considered to be a valuable training aid for this specialized equipment.

The Fire Attacks on German Cities.

By Horatio Bond,

Chief Engineer, National Fire Protection Association.

The great lesson to be learned in the battered towns of England and ruined cities of Germany is that the best way to win a war is to prevent it from occurring. That must be the ultimate end to which our best efforts are devoted.

U. S. Army and civilian experts, including fire engineers, have been engaged for nearly a year in studies of how the Allied Air Forces helped to defeat Germany. In October, the U. S. Strategic Bombing Survey issued Summary and Over-all Reports on the bombing of Germany to the Secretary of War, who had organized the Survey by direction of the President. These were issued over the signature of Franklin D'Olier, President of the Prudential Insurance Company of America, Chairman of the Survey, and a board of nine divisional directors. The quotation with which this article opens is from the Summary Report.

Fire destruction was very great. One fire in Hamburg caused by an attack by the Royal Air Forces in 1943 was probably the greatest fire to that date in history. This might have been an important story in itself, but the atom bomb has introduced possibilities of so much greater destruction that the results of incendiary attack in Germany tend to be obscured.

HE Bombs and Incendiaries.

The destruction in Germany was caused by high explosive bombs and incendiaries. The high-explosive bombs used by the American Air Forces were in the 100-, 200-, 500-, 1000-, and 2000-pound sizes. (In addition, the Royal Air Forces had 4000-, 8000-, 12,000-, and 22,000-pound bombs.) The principal incendiaries, (among others), used by both Air Forces were the 4-pound magnesium type. This type is familiar to most people in Britain, as the same type was dropped by the Germans. Canadians, Americans, Australians and others have seen the magnesium bomb work in civilian defense training. It is a tube of magnesium with a thermite igniter and a 2-pound iron head to give it penetration through roofs and floors. Large incendiaries in 100- and 500-pound sizes were also used by the U. S. Air Forces, and the Royal Air Forces had a 250-pound size. These were filled with oil or oil compounds. These large incendiaries were developed and often used against the practically unanimous advice of fire and statistical experts. Results proved that dropping many small incendiaries scored more hits than dropping a relatively few big ones. However, the light 4-pound bombs would not penetrate much below the attic or top floors of German buildings. Therefore, the Royal Air Forces had two types of 30-pound bombs which could be depended on to reach lower floors of most four- and five-story buildings. The first of these was filled with a benzole compound and a little white phosphorus. This was commonly referred to as the 30-pound oil bomb. In attacks on cities it was frequently used in combination with

In most cities there were no fire storm phenomena and a typical fire in a building would be like that illustrated above where the building burned out individually without spread of fire to or from adjacent buildings. The buildings on either side in this case were either not hit by incendiaries or the fires were put out without damage. There was no spread of fire because of good division walls. Picture taken in Pirmasens.

the 4-pound magnesium incendiary on about a 50-50 basis by weight. The other British 30-pound bomb (and a 22-pound model operating in a similar manner) was essentially a blowtorch.

These were the weapons with which the German cities and industrial plants were attacked. Incendiaries were seldom used by themselves, and their results were in some part enhanced by the accompanying HE bombs. HE bombs caused damage by blast, fragmentation, debris, cratering and undermining. In some cases they caused fires, but this was a secondary and relatively minor factor. They delayed and interfered with fire fighting. The incendiaries set most of the fires.

Aside from the atom bomb attacks on Hiroshima and Nagasaki, there is a chapter to be written about the incendiary attacks on Tokyo, Yokohama and other Japanese cities, in which small oil type incendiaries, unsupported by high explosives, caused widespread devastation. The Strategic Bombing Survey is engaged in study of these attacks, and this study will be the subject of further reports by the N.F.P.A. when the survey reports become available.

The Survey's Fire Staff.

The work of reporting on fire damage in Germany was contributed to by a small number of fire protection engineers who were among the personnel of the Survey, which totaled over one thousand. Assessment of fire fighting and public protection service was assigned to the Survey's Civil Defense Division, headed by Colonel Frank A. McNamee. Chief Anthony J. Mullaney, N.F.P.A. Director and Chief of the Chicago Fire Department, and Chief Frank McAuliffe, Chief of the Chicago Fire Insurance Patrol, were on the staff of the Civilian Defense Division. James K. McElroy, now of the N.F.P.A. staff, who prepared the story on Incendiary Warfare on Germany (QUARTERLY, July, 1945, Vol. 39, No. 1, p. 15), was working on target analyses for the Economic Warfare

Where dwellings were set on fire by incendiaries the fire usually burned downward from the roof. Note in this picture taken in Pirmasens that the wood trim in the windows and door openings and combustible shutters show only traces of fire damage. Where these unburned combustibles could be seen on outside of buildings, it was certain fire did not come in the windows as an exposure. Walls between dwellings in rows were often not true fire walls. Like these, they were often without parapets, and holes for the support of floor beams provided channels for fire spread.

Division of the U. S. Embassy in London in November, 1944, at the time of organization of the Survey and was consulted in setting up the German studies to be made by the Physical Damage Division. This division was directed by Professor Harry L. Bowman, head of the Civil Engineering Department, Drexel Institute, Philadelphia. Conferences at this time in the Survey headquarters in Washington established the need for fire engineering personnel. I was requested to handle fire damage analysis work for the Physical Damage Division. Later associated with me were the following other officers and civilians whose fire protection background was representative, as indicated by their previous connections in the following list: Major Forrest J. Sanborn, Improved Risk Mutuals, Chicago; Mr. Miles W. Brown of Charlotte, N. C., and Captain Percy E. Harvey of New Haven, both of the Inspection Department, Associated Factory Mutual Fire Insurance Companies; Captain Gerald O. Waeterling, Travelers Fire Insurance Company, Hartford; Captain Robert Merz, Middle Department Rating Association, Philadelphia; Captain Elmer R. Hjortsberg, Chicago Board of Underwriters, Chicago; Lieutenant Jack S. Raines, Texas State Fire Insurance Department, Austin; Mr. Walter Weldele, 6th Service Command, Chicago. Captain John S. Ferguson, Southeastern Underwriters Association, was on the staff of the Survey's Area Studies Division. The Survey staff followed the armies in France and went into Germany as fast as territory there opened up. All traveled thousands of miles and saw many cities and studied hundreds of bombed industrial plants.

The Physical Damage.

The Survey's field work is recorded in over 200 volumes of reports from which, to date, only the highlights have been made available, as for example the follow-

ing statement on physical damage from the Over-all Report.

Germany presented, at the close of hostilities, many contrasting aspects. Great stretches of countryside and many small and medium cities had suffered no physical damage from the Allied bombing offensive; but 49 of the larger cities, those of industrial importance, had 39 per cent of their dwelling units destroyed or seriously damaged (2,164,800 out of 5,554,500), and many of these cities had lost their central and business districts and remained as suburban rings surrounding destroyed cores. The majority of industrial plants, those that served strategically unimportant industries and were in locations that escaped area attacks, were undamaged; but great numbers of plants in industries of strategic importance were crushed.

There are two parts to the story of fire destruction in the German attacks: one, what happened to the industrial plants; the other, the destruction of cities as such.

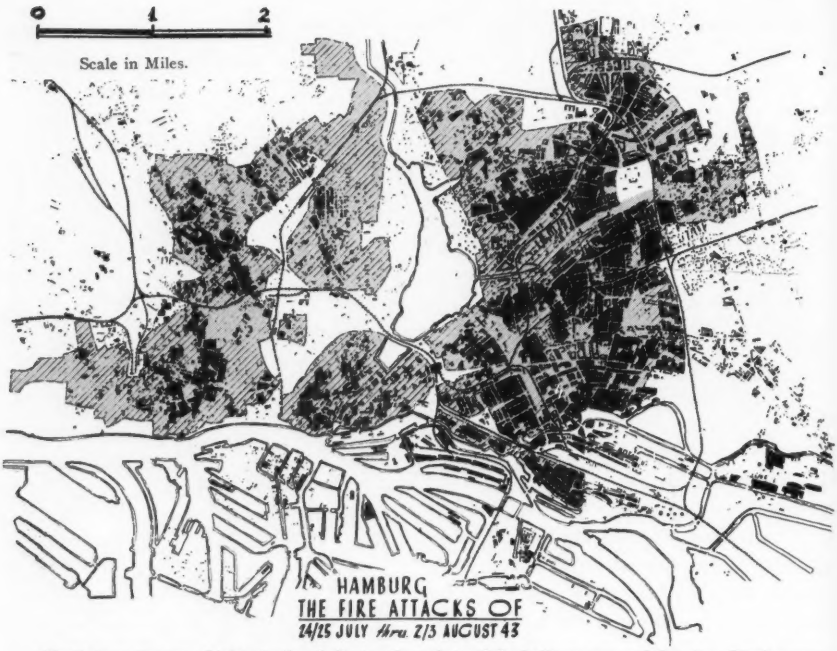
Incendiaries were effective in city areas. The photo studies of damage indicated that, ton for ton, incendiaries were 4.8 times as effective as high explosive bombs on residence areas and against the smaller industrial and mercantile properties. This was due, of course, to combustible contents, wood floors and roofs.

The German Industrial Plants.

In the larger isolated industrial plants the effect of incendiaries was summarized as "variable and not clear cut." In general, fire damage occurred where fire protection engineers predicted: in combustible occupancies and buildings with wood floors and roofs. A more specific statement will have to await the analysis of the Survey's 200 volumes of plant reports. This is a huge job. There are valuable reports, made by experienced technicians, on damage both by the effects of HE bombs and fire, covering plants in such industries as oil, rubber, chemicals, machine tools, motor vehicles, aircraft, electrical equipment, utilities, transportation and others. Some of the points noted by fire protection engineers making plant reports were the following:

In fire storm areas, where the fire was general, temperatures were high enough to ignite all combustibles. However, there were many areas where practically every building was on fire yet there was no indication of any material spread of fire from building to building. The above picture was taken in an area of Hamburg where street frontages were completely built-up, and where all the buildings near by were completely burned out. It is doubtful if there was much fire coming out of windows to form an exposure, as window boxes, not even scorched, can be seen on the balcony rails. Each building appeared to have burned out individually in fires which started in the roof and spread downward relatively slowly.

Yard and hydrant systems, although ample, were damaged by HE bombs and



North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Hamburg, population 1,760,000, was attacked many times, particularly its dock areas. The principal destruction in the city itself was the result of three attacks by Royal Air Forces in July, 1943. These attacks were of approximately equal weight: each (round figures) 700 planes carrying 1,300 tons HE bombs, 500 tons 30-pound oil incendiaries, 600 tons 4-pound magnesium incendiaries. The city is 55-60 per cent destroyed: at least 67,000,000 square feet of buildings (plan area) is totally destroyed or has suffered heavy damage. This does not count damage of a superficial character, such as roof stripping and breakage of windows. Damage by fire was 75-80 per cent of total damage. Water mains were broken in 847 places in these three attacks.

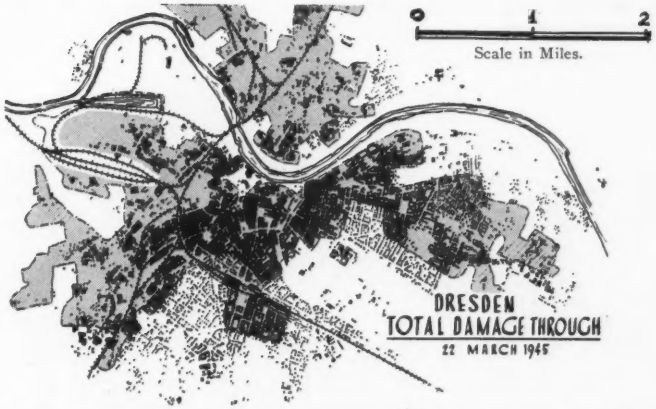
in many cases rendered useless for fire fighting. Static water tanks, steel above-ground tanks and tanks or basins of concrete construction below ground level were provided for fire fighting. On tank farms, oil storage tanks were filled with water.

Portable, gasoline-driven pumps were extensively used in lieu of motorized fire apparatus. Smaller plants relied principally upon public fire departments.

Interior and exterior alarm systems reporting to control headquarters were quite common but were usually put out of service by HE bombs. Watchmen-and-clock or fire-watch service was usually provided.

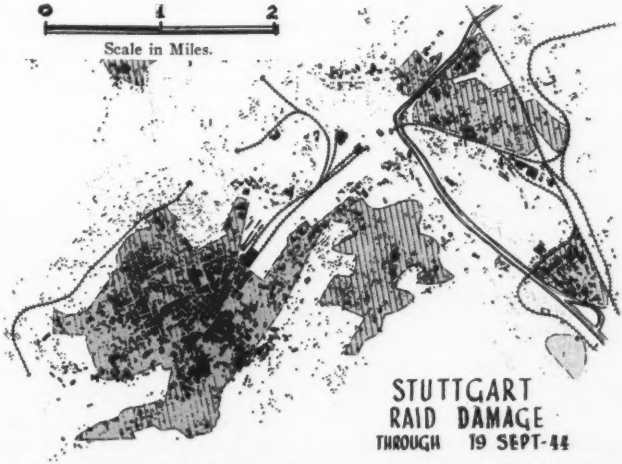
Few of the plants were sprinklered. Of the installations seen it was noted that control valves were poorly located and piping was small. Foam was widely used for protection to flammable liquid storage. HE bombs often destroyed the piping of fixed foam systems. In the oil and chemical industries spray nozzles with hand extension applicators were in evidence on some of the fire trucks within the plants.

All plants were well equipped with fire extinguishers, with a good reserve supply. Sand in buckets, drums, boxes and barrels,



North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Dresden, population 633,000, was attacked in force late in March, 1945, by the RAF at night and by a heavy AAF attack the following day. Fire engineers were unable to visit Dresden at the time of the survey field work, but German fire chiefs said the attacks resulted in many areas completely burned out and that a great fire storm like that at Hamburg occurred. The loss of life was similar to and may have been greater than at Hamburg. A New York Times story, which came from the Russian Zone, 2 January 1946, says 300,000 dead. The damaged areas were plotted from aerial photographs to make the above map.



North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Stuttgart, population 503,000, was repeatedly attacked, but the greatest damage was done in an attack just prior to the plotting of damage from aerial photographs indicated on the above map. The Stuttgart fire chief described the fire in the principal mercantile district as a fire storm.

North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Wuppertal, population 386,000, is made up of twin cities, Elberfeld (east) and Barmen (west). Elberfeld 80 per cent destroyed, Barmen 60 per cent. At least 23,000,000 square feet (plan area) of buildings totally destroyed or heavily damaged; also 44,000 family dwelling units (37 per cent of total). Damage by fire 80 per cent of total damage. Large feeder water mains broken in 24 places and 80 breaks in smaller mains. Damage due to two attacks by Royal Air Forces: each (round figures) 500-600 planes carrying 900 tons HE bombs, 400 tons 30-pound oil incendiaries and 650 tons 4-pound magnesium incendiaries. Attack of 30 May, 1943, on Barmen set fires over an area of 3.76 square miles with concentrated damage in an area of 1 square mile. Loss of life 3,400. Attack of 24/25 June, 1943, on Elberfeld set fires over an area of 5.8 square miles with concentrated damage in 2 square miles. Life loss 1,800 (many evacuated city after Barmen attack).

as well as water, was used on incendiary bombs.

Government agencies furnished much literature to plant managements regarding the necessity of maintaining fire extinguishing equipment at all times, and required constant training of personnel in ordinary and specialized phases of fire fighting.

Fire walls were numerous, but protection of openings in such division walls was poor. It was common to note fire doors installed only on one side of the wall. Most doors were of sheet metal filled with mineral wool or asbestos. They were for the most part hung on steel frames with ordinary hinges. Most were non-automatic. Where automatically operated, fusible links were not properly located. Most doors were provided with ordinary latches, and invariably they were blown open by blast.

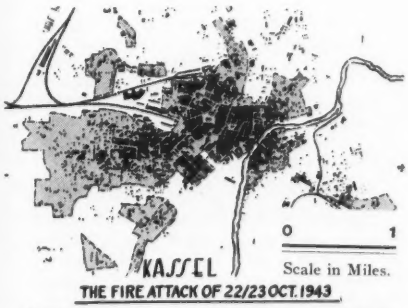
The Survey's Over-all Report contains the following observation in reporting on Civilian Defense measures in industrial plants:

Industrial plants in Germany had excellent factory air-raid-protection forces which were well organized, trained and equipped. The same was true of the national railroads and of the national post-office department, which controlled telephone and telegraph communications as well as postal services. In each instance, close cooperation was maintained with local civilian defense authorities, not only for the

exchange of warnings and information, but for the rendering of assistance when it was required. It is noteworthy that mutual aid was not rendered between factory and factory, but between factory and municipality. That procedure was contrary to the accepted routine in other phases of mutual aid. Within the municipality, for example, coordinate agencies mutually supported each other. Likewise, higher political and military divisions came to each others' assistance when required. Factory fire-fighting forces, however, were auxiliaries of the municipal fire department of the nearest city, and were generally so well organized that they were able to lend more aid to the city than they required from it.

The City Attacks.

City attacks were principally made by the Royal Air Forces. This was because the RAF was attacking Germany for several years before the AAF forces arrived in sufficient force. Also, AAF attacks were usually aimed at specific targets like industrial plants located in the outlying parts of cities. The USSBS Report notes, however, that as a practical matter there was often little difference in the effects of RAF and AAF bombing operations. Many bombs aimed at specific targets (particularly in the case of railway yard targets), necessarily found their way into city areas, just as RAF bombs were aimed at city areas with the expectation that some of them would find industrial targets. (In speaking of the Royal Air Forces, QUARTERLY readers will note the use of the plural here to indicate the broad origins



THE FIRE ATTACK OF 22/23 OCT. 1943

North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Kassel, population 228,000, was destroyed approximately 30 per cent (most of the center of the city) by great fires and a fire storm. This was the result of one principal attack by the Royal Air Forces 22/23 October, 1943, in which (round figures) nearly 500 planes carried 900 tons HE bombs, 300 tons 30-pound oil incendiaries and 800 tons 4-pound magnesium incendiaries. These set fires in an area of 23 square miles with concentrated damage in an area of 2.9 square miles. At least 11,000,000 square feet (plan area) of buildings was totally destroyed or heavily damaged; also 24,000 family dwelling units (40 per cent of total). Damage by fire 70 per cent of total damage. Feeder main breaks, 22. Loss of life 8,700 (mostly fire deaths).

THE FIRE ATTACK OF 11 SEPT. 44

North is at the top. Light shading indicates the substantially built-up areas of the city. Black represents blocks and buildings completely destroyed or heavily damaged.

Darmstadt, population 109,000, was destroyed about 70 per cent by a fire storm which took out most of the center of the city. This was result of one principal attack by Royal Air Forces 11/12 September, 1944, in which (round figures) 240 aircraft carried 400 tons HE bombs and 600 tons 4-pound magnesium incendiaries. These set fires in an area of 4.1 square miles with concentrated damage in an area of 1.5 square miles. About 10,000,000 square feet (plan area) of buildings was totally destroyed or heavily damaged; also 20,000 family dwelling units (64 per cent of total). Damage by fire 80 per cent of total damage. Feeder mains broken in 8 places. Loss of life 8,110 (mostly fire deaths). For a small city this was heavy damage.

North is at the top. Scale: 1 inch is 1.96 miles.

A German map of Hamburg, showing how the three principal Royal Air Forces attacks of July, 1943, fell on the city. The attack of 24/25 July hit the western half principally (fine diagonal shading) Altona, Eimsbüttel and Innenstadt (city center); also part of Wandsbek (east). About 2,000 people were killed. The attack of 27/28 July, the most effective, hit east of the city center, mostly in St. Georg (cross-hatching.) Life loss 60,000 to 100,000. The attack of 29/30 July hit to the north (coarse diagonal shading) in Uhlenhorst and Barmbeck-Nord. Life loss about 800, as many had evacuated the city.

of these forces in Canada, Australia, New Zealand, South Africa and other parts of the British Commonwealth as well as in the United Kingdom). The USSBS Over-all Report summarized the city attacks:

> Many German cities presented partial areas of vast devastation. Perhaps the outstanding example was Hamburg, where a series of attacks in July and August of 1943 destroyed 55 to 60 per cent of the city, did damage in an area of 30 square miles, completely burned out 12.5 square miles, wiped out 300,000 dwelling units, and made 750,000 people homeless. German estimates range from 60,000 to 100,000 persons killed, many of them in shelters where they were reached by carbon-monoxide poisoning.

The Survey's estimate of the total loss of life due to bombing of Germany is only 305,000 dead. The Hamburg fire deaths alone accounted for about a fifth of all deaths. The USSBS Summary Report says:

> No subsequent city raid shook Germany as did that on Hamburg; documents show that German officials were thoroughly alarmed and there is some indication from interrogation of high officials that Hitler himself thought that further attacks of similar weight might force Germany out of the war.

The Over-all Report, however, devotes considerable space to figures indicating that the area raids on Hamburg and other cities had disappointing results on production. In most cities war production was resumed in a month or so. All bombing on city areas, AAF and RAF, may have reduced Reich production as much as 17 per cent in 1944. The Over-all Report con-

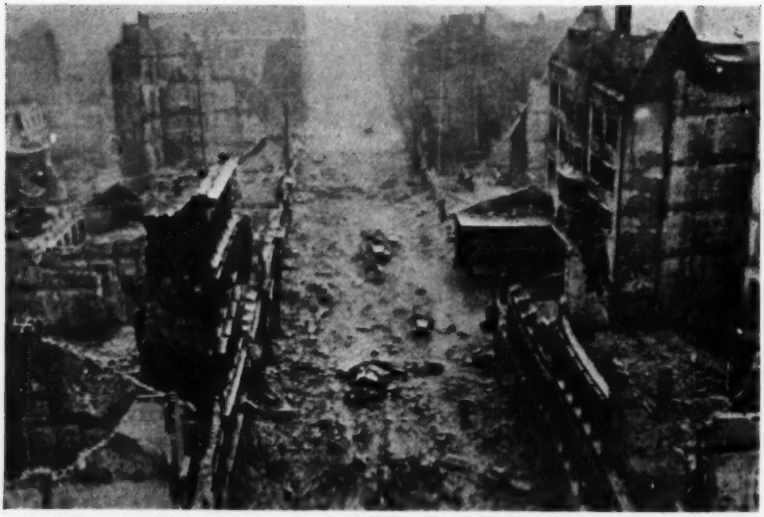
North is at the top. Scale: 1 inch is 1.56 miles.

A German map of the areas in Hamburg completely burned out in the great fire attacks indicated by the wash shading. The black blocks are those in which there were individual fires and damage by HE bombs. The attack of 24/25 July set fires over an area of 18.5 square miles, and the areas of concentrated fire totaled 1.5 square miles, mostly in Altona and Eimsbüttel (west of Aussen-Alster, the body of water in the center) and in the city center (at the south end of the Alster). Street frontage involved in these fires totaled 54 miles. The attack of 27/28 July set fires over an area of 17 square miles and the area of concentrated fire was 5.1 square miles (one huge area in this case) mostly in St. Georg (southwest of the Alster). Street frontages involved in this great fire area totaled 133 miles. The attack of 29/30 July set fires over an area of 10 square miles and the area of concentrated fire was 2.2 square miles (northeast of the Alster) mostly in Uhlenhorst and Barmbeck-Nord. Street frontages involved totaled 104 miles.

tinues discussion of the Hamburg attacks and fire damage:

The attacks used both high explosive and incendiary bombs as it was thought by the Air Forces and later confirmed that the former created road blocks, broke water mains, disrupted communications, opened buildings, broke windows, and displaced roofing. Most important, they kept the fire fighters in shelters until the incendiaries became effective. But, of the total destruction, 75 to 80 per cent was due to fires, particularly to those in which the so-called fire-storm phenomenon was observed.

Fire-storms occurred in Hamburg, Kassel, Darmstadt, and Dresden. Differing from an ordinary peacetime conflagration which begins at a center and then spreads, these storms occurred when incendiaries started many fires within a relatively short time over an extensively built-up area. It was estimated that, in Hamburg, within 20 minutes, two out of every three buildings were afire within a 4.5-square-mile area as the result of incendiary bomb



A German picture showing the conditions of streets in a fire storm area of Hamburg just after the attack. The buried vehicles are fire trucks which had to be abandoned due to heat. This street was essentially a flue filled with flames and flying brands.

strikes. The intensity of the bomb fall was so great that fire-fighting efforts were fruitless. As the many fires broke through the roofs of buildings, there rose a column of heated air more than 2½ miles high and 1½ miles in diameter, as measured by aircraft flying over Hamburg. This column was turbulent and was fed at its base by inrushing cooler ground-surface air. One and one-half miles from the fire this draft increased the wind velocity from 11 to 33 miles per hour. At the edge of the area the velocities must have been appreciably greater, as trees 3 feet in diameter were uprooted. In a short time the temperature reached the ignition point for all combustibles and the entire area was ablaze. In such fires complete burn-out occurred; that is, no trace of combustible materials remained and only after 2 days were the areas cool enough to approach.

Many additional cities showed heavy fire losses, even though the intensities were less than the above. For example, Berlin was estimated to be 60 to 70 per cent destroyed, and the fire department officials of the city stated that three-fourths of the damage was caused by fire.

Bad fires accompanied the bombing of almost all cities attacked. The following 34 cities (population given in thousands) are known to have sustained heavy attacks with incendiaries and all have extensive burned-out areas (data are not available on most of the cities in Eastern Germany).

Berlin	4,420	Wuppertal	386
Hamburg	1,760	Magdeburg	353
Munich	885	Homberg	320
Cologne	757	Genselkirchen	318
Leipzig	707	Bochum	312
Essen	672	Kiel	302
Dresden	633	Brunswick	230
Frankfort a.M.	560	Kassel	228
Düsseldorf	539	Karlsruhe	190
Dortmund	537	Augsburg	190
Stuttgart	503	Krefeld	171
Hannover	473	Mainz	152
Mannheim-Ludwigshafen	446	Münster	142
Bremen	440	Wilhelmshaven	132
Duisburg	438	München-Gladback	123
Nürenberg	425	Darmstadt	109
Stettin	396	Osnabrück	105

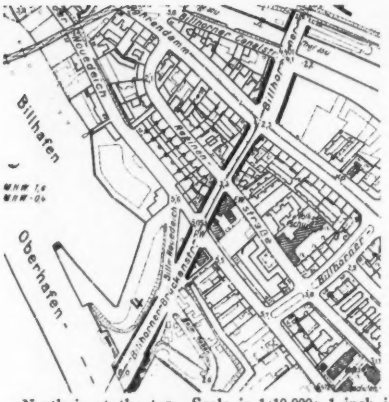
Berlin, incidentally, was harder to burn than most of the other German cities.

One of the areas in the 24/25 July, 1943, incendiary attack on Hamburg. A German picture of a district near the city center taken some time after the fire (streets have been partly cleared). This gives a good idea of the height and bulk of buildings involved. This particular group of buildings was less well subdivided with brick fire walls than similar buildings in most German cities. It was not in fire-storm area.

There was better construction and better "compartmentation." In other words, residential buildings did not present as large fire divisions or fire areas. Approximately twice as many incendiaries had to be dropped to assure a fire in each fire division.

To show the average character of damage produced in cities by bombing, the best figure is that already quoted from the Over-all Report that 49 of the principal cities had lost 39 per cent of the family residential units. The widespread character of damage is shown in accompanying maps. A complete canvass of all German cities has not been made, so it cannot be said that Hamburg, Dresden, Stuttgart, Kassel and Darmstadt were the only ones to have had fires with fire-storm characteristics. Thousands of buildings were destroyed by fire in Munich, but these were individual burnouts for the most part. This was also true in Wuppertal, Krefeld and Pirmasens, where detailed studies were made. General studies were made of the fires in Hamburg, Wuppertal, Kassel, and Darmstadt. A study of 10 blocks was made in Krefeld and a study of Pirmasens covered every building in the city. The following summaries of the damage in Krefeld and Pirmasens is given for comparison with the data accompanying maps of Hamburg, Wuppertal, Kassel and Darmstadt. The completeness of the Pirmasens study furnished a basis for judging that estimates made of fire damage elsewhere were of the right order.

Krefeld, population 171,000. Destruction about 25 per cent: about 12,000,000 square feet (plan area) of buildings totally destroyed or heavily damaged, also at least 15,000 family dwelling units (30 per cent of total). Damage by fire 80 per cent of total damage. In one principal attack 21/22 June, 1943, by Royal



North is at the top. Scale is 1:10,000; 1 inch is 833 feet, 6.33 inches is 1 mile.

A section of Hamburg at the southerly edge of the fire storm area of the attack of 27/28 July, 1943. This fragment adjoins the south end of the full page map fragment herewith. At a fire station, corner Reginenstrasse and Billhorner-Brückenstrasse, winds too strong to stand against were experienced. The fire area extended some two miles north. At the fire station the wind was northwesterly, blowing counter-clockwise at edge of storm.

North is at the top. Scale is 1:10,000; 1 inch is 833 feet, 6.33 inches is 1 mile.

A store and dwelling in Hamburg at the corner of Desenisstrasse and (the diagonal street) Hamburgerstrasse in the center of this map fragment was pointed out as typical of the locations in which deaths primarily due to carbon monoxide poisoning (and not burns) occurred. Victims were in the store cellar and the street outside. The area of complete burnout was bounded by the railway shown and extended about one-half mile northerly.

Air Forces (round figures) 600 planes carried 1100 tons HE bombs, 400 tons 30-pound oil incendiaries and 700 tons 4-pound magnesium incendiaries.

Pirmasens, population 50,000. An accurate estimate of the destruction showed 37 per cent completely destroyed plus heavy damage to 5 per cent additional: about 3,000,000 square feet (plan area) of buildings. Damage by fire 68 per cent of this total plus 11 per cent additional due to mixed fire and HE bomb damage. Water mains broken in 71 places. About 600 deaths. Five attacks as follows: In four 8th USAAF attacks (9 August, 1944, 28 December, 1944, 3 and 5 January, 1945), 183 planes carried 400 tons HE bombs, 94 tons 500-pound incendiaries and 77 tons 4-pound magnesium incendiaries. One 9th USAAF attack (15 March, 1945), had 244 planes carrying 270 tons HE bombs and 180 tons 4-pound magnesium incendiaries.

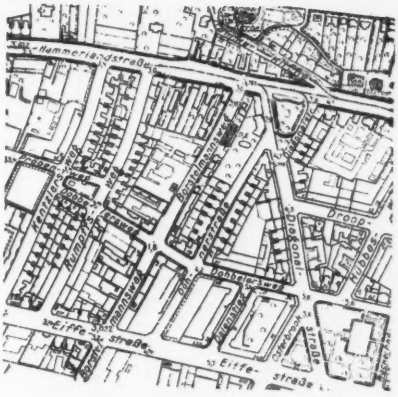
The Pattern of German Cities.

In a German city the pattern is about as follows. The "old town" forms the center and is closely built up with narrow and winding streets. The buildings average about 1500 square feet in area and are three to five stories, depending on the size of the city. They have several tiers of attics strongly framed in timber, with roof ridges at right angles to the street.

The eighteenth century town is built around the old town. This has a rectangular street pattern and buildings are three to six stories. They are slightly greater in individual area, but few are over 3000 square feet. Most of the buildings have masonry walls, heavy wooden pugged floors, and tile or slate roofs on wooden battens. Roof ridges parallel the street and are often continuous. Each unit is separated from the next by a common wall. Some of these are parapeted above the roof and some reach to just under the roof. There are often small ("backyard") industrial buildings in the center of these blocks.

The more modern sections of the city are built around the eighteenth century town with wide streets and buildings of modern construction. Even in these modern buildings, areas are small and wood floors are common and roof supporting members are wood.

As the central portions of these cities have 40 per cent or thereabouts of the area built upon with multiple-story buildings, they make an excellent target for incendiary attack. The presence of party walls means, however, that little can be expected in the way of free spread of fire from building to building. It was necessary, therefore, to drop enough incendiaries so that each space between walls was hit by enough incendiaries to assure the building taking fire. The buildings destroyed in the German cities by fire were lost because they were hit by bombs rather



North is at the top. Scale is 1:10,000; 1 inch is 833 feet, 6.33 inches is 1 mile.

The accompanying photograph was taken looking south on Borstelmannsweg in Hamburg. This map fragment shows plan outlines of buildings and with the photo makes it possible to visualize the bulk of buildings completely burned out. Individual buildings in residential rows were about 2,000 square feet area.

Looking into a part of the fire-storm devastated area of Hamburg, where complete burnout occurred. (Compare with accompanying map fragment.) There were individual building fires in the area back of the cameraman, but the area of general fire was broken by the street in the foreground plus a number of blocks not heavily built-up. Buildings in the burned area had basements and attics, plus two to five stories. Construction was brick for outside walls and interior partitions, floors and roofs wood.

North is at the top. Scale is 1:10,000; 1 inch is 833 feet, 6.33 inches is 1 mile.

Part of Amt St. Georg in Hamburg, showing street widths and plan outline of buildings. Large industrial buildings in the blocks on west side of area shown were not mapped on the sheet from which reproduction was made. This area and a larger area to the east was so completely destroyed that it is referred to as the "dead city." The fire was so general no combustible material remains except in a few buildings which escaped damage probably because they were not hit by bombs and because of large open spaces around them. These exceptions were one outlined just above the word "Mittelkanal" east of railroad, one in the lot east of Volksschule and Sportplatz on Wendenstrasse and some in the two blocks west of railroad between Südkanal and Bullerdeich. Large numbers of persons died from inhalation of hot gases and from burns in these streets, particularly at Berliner Tor (at the head of Heigenskampsweg), at the junction of Heigenskampsweg and Bullerdeich and in Hammerbrookstrasse near Mittelkanal.

Air photo of part of the so-called "dead city" area of Hamburg. The left half of this photo is the same shown in the map on page opposite, and is helpful, with the map, in visualizing the relative size of buildings, street widths and open spaces.

than because fire spread from other buildings.

Most of the incendiary bomb fires were started in the attics and upper floors so that the normal course of fire spread within buildings was downward. Under these conditions fire spread would be relatively slow. There is much evidence of this. Buildings were completely burned out without setting fire to wooden window frames, shutters or other outside trim.

In the cities which experienced fire storms there was spread of fire from building to building. HE bombs stripped off

roof tiles and broke windows. Flying brands, carried by convection currents, could spread fire from building to building.

It was impossible to isolate the respective effects of spread due to direct heat and flames, flying brands and radiated heat, all of which contributed. Most of the buildings were hit by one or more incendiaries. It would not be uncommon for a building to have as many as twenty hits. Under these conditions all the buildings in the neighborhood would be on fire at the same time, and the spread factor was perhaps relatively unimportant. The large number of fires would certainly tend to raise the general temperatures above the ignition temperatures of wood, which would assure the ignition of any building not itself hit by an incendiary.

The Fire Deaths.

The best estimate of the cause of fire deaths was obtained in Kassel. Deaths due to HE bombs caused the smallest part of the loss of life, only about 15 per cent. Deaths due to burns and to the inhalation of hot gases were also small, 15 per cent. By far the largest proportion of the deaths, 70 per cent, were due to carbon monoxide poisoning. This appeared to be typical of the fire deaths in all of the cities which experienced fire storms (large areas all on fire at once).

The proportions of fire deaths were lower in other cities suffering great fire attacks. At Wuppertal, where there was no fire storm, but simply a large number of individual buildings on fire, fire deaths made up 65 per cent of the total.

In the areas where life loss due to fire was studied, the typical German dwelling was five stories with brick, load-bearing walls, wood floors and roofs. The wood members used were heavy, producing a total amount of combustible material which was considerable. The basements of these buildings had ceilings of brick arches or similar construction. These ground floor constructions were quite general in Germany for many years as a fire protection measure. The basements offered a fairly satisfactory shelter from HE bombs and in many cases from fires in the building or in the neighborhood.

In the fire storm areas, the fires were so general that they appeared to draw good air out of the basement to feed the fire. Incoming drafts from the opposite side of the building appear to have brought in with them the gases which are normal products of combustion, including carbon monoxide. The deaths, therefore, were due to persons being in these shelters and being kept there by exploding HE bombs.

The incidence of loss of life seems to be connected as much with the total bulk of combustible buildings in the neighborhood as any other one factor. It was fairly common to find areas where the building heights were somewhat greater than the widths of the street. At Hamburg, for example, buildings 55 to 75 feet high range both sides of streets only 60 feet in width. Although the percentage of deaths due to burns and inhalation of hot gases was small, thousands died in streets of these dimensions. With fires general in the area, and with a draft tending to go to the center of the fire storm area, many of these streets must have been simply large flues.

For most of the people, there was no question of getting away from the fires. The areas hit were so great that it would have been a physical impossibility for any substantial number of people to get out of the fire areas simply because of the travel time involved. In the cities people found

A burned-out fire-resistive building in Stuttgart, a department store in the central area. It was exposed on right by 5-story buildings of joisted construction, an exposure which would have assured its destruction by fire spreading through unprotected large glass areas. However, burnout was caused by fires set by incendiaries which came in windows on most floors. Such fire-resistive buildings were almost all restored to a measure of use, like this one, by bricking up the glass wall areas.

safety in open spaces, but spaces of as much as 500 feet in diameter were frequently not sufficient. The best places were large parks, with bushes, provided there was sufficient water in the vicinity to keep clothing wet to prevent ignition from a rain of brands.

The Weather Factor.

Weather conditions may have been one of the reasons why certain of the attacks on German cities resulted in widespread destruction. They were perhaps more a factor in helping the incendiaries to start fires than in any other way. This part of the problem of air attack has been inadequately explored, but in the greatest raids on Hamburg, weather conditions were certainly favorable for the starting of fires. There had been a month of unusually dry weather. Dry weather, too, was said to precede successful attacks at Kassel, Wuppertal and Darmstadt.

A good weather station at Hamburg had complete data. In the three weeks before the series of attacks there had been only 1¾ inches of rainfall, the largest amount, ½ inch, falling on 22 July. The first heavy attack came on the night of 24 July, the second and most disastrous on the night of 27 July and the third on the night of 29 July.

Humidities were high at night. The lowest reading at 7 A.M. between 1 and 29 July was 78 per cent and at 9 P.M. was 56. There was an abnormal drying-out process going on in the days immediately preceding the attacks, as shown by 2 P.M. readings of 46 on 21 July, 46 on 25 July, 41 on 26 July, reaching the abnormally low figure of 30 per cent on 27 July, the day preceding the most successful attack.

Between 1 and 29 July, day temperatures were 38 to 90 degrees Fahrenheit and night temperatures 47 to 86 degrees. While top daily temperatures were seldom

over 70 the first 15 days of the month, they were between 70 and 80 between 15 and 25 July, and 84 and 90 on the 26 and 27 July, just before the most successful fire attack. Temperatures reached 90 and 86 on 28 and 29 July.

Fire Fighting.

It may be said of fire fighting operations that the great fire attacks simply overwhelmed all such efforts. There were too many individual incendiaries for first-aid fire fighters to find them all. There were too many fires requiring public fire department attention. Once an area was on fire, the public fire brigades were generally able to prevent spread outside the area hit. No case was observed where a fire spread much more than a block from where it started if there were any fire fighting facilities at all available. Fire fighting, however, was confined simply to the buildings on the fringe of the fire and even this took all of the available manpower and equipment. There is a special story in itself of the fire fighting problems under air attack. These were studied by the USSBS Civil Defense Division from whose findings the Over-all Report observed:

> In handling fires, attempts were made to utilize natural water sources and static water supplies, but no efficient method was established for the quick, separate replenishment of static water tanks, nor were water mains laid which were independent of the regular water-supply system. Consequently, a heavy concentration of additional fire-fighting apparatus soon depleted the static water supply and reduced the water pressure in the mains to the point of ineffectiveness. Such was the case in Hamburg in the conflagration where, in addition to the 288 pieces of fire apparatus and 36 fire boats of the local fire department, a total of 1062 fire-fighting vehicles were sent into the city in an effort to control the fire.
>
> In the operation of local fire departments, nationalization was attempted, but it was never accomplished to the extent of that of the National Fire Service of Great Britain, although it did result in complete standardization of fire pumpers, of hose connections and couplings, and other equipment. To that extent it was beneficial. The absence of heavy-duty pumpers and facilities for the production of high-caliber fire streams, the use of single-jacketed hose, and the loss of communication and control brought about by the lack of two-way radios and "walkie-talkies," were weak points in fire protection.

In Conclusion.

This is a story about the destruction of cities. I must emphasize that it was not hit-or-miss. The amount of destruction to both cities and industries could be calculated in advance. Fire engineers were helping to do it not only against Germany, but against Japan. The atom bomb is not needed to point to the conclusion. Ordinary incendiaries had proven it before the atom bomb came along. It is appropriate to close this article as it started, with a significant quotation from the USSBS Summary Report.

> The city area raids have left their mark on the German people as well as on their cities. Far more than any other military action that preceded the occupation of Germany itself, these attacks left the German people with a solid lesson in the disadvantages of war. It was a terrible lesson; conceivably that lesson, both in Germany and abroad, could be the most lasting single effect of the air war.

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A.D.T. Protection Services are inseparably linked with proper maintenance. Behind every A.D.T. installation there is an organization of protection specialists which provides continuous supervision, periodic inspections and systematic tests and unceasingly maintains the protective signaling system in proper operating condition.

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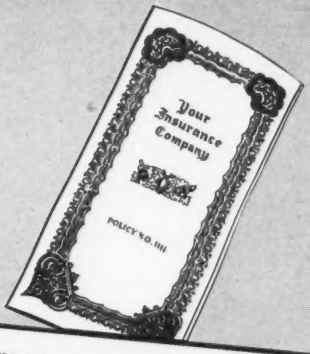
S. & J. Weatherproof Breather, Fig. ST-949, installed atop an S. & J. Flame Arrester, Fig. ST-863 (listed by Underwriters Laboratories). This combination assures the maximum protection against fire . . . and provides for normal tank breathing.



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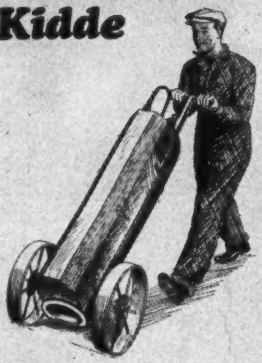

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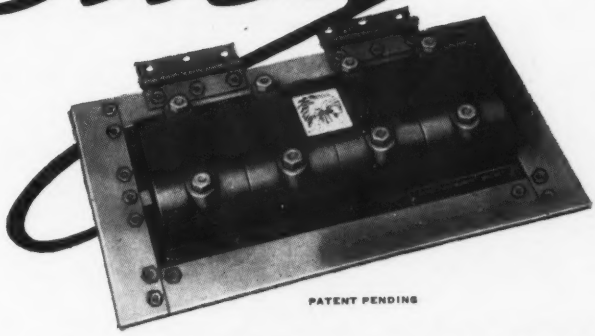

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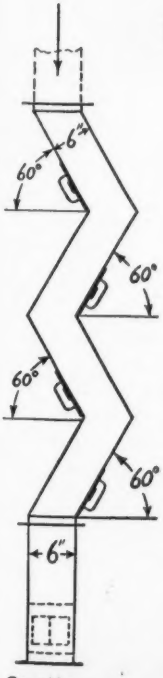
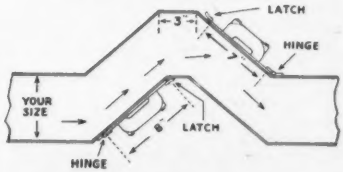


SIDE VIEW

Above: **Typical installation in bottom of chute.**

Left: **Powder mill chute installation.**



Typical pneumatic duct installation—Note baffle effect of magnets.

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The experience Fire Appliance Company had gained in the manufacture of spray nozzles was put to work by the Army and Navy. For the Army and Army Air Forces we built Aqua-Gas nozzles. For the Navy's Bureau of Ships program we made all-purpose nozzles, many thousands of which have been used throughout the world.

New Aqua-Gas nozzle outperforms wartime model

Two years of intensive research, in cooperation with the Bureau of Aeronautics of the U.S. Navy, resulted in the Aqua-Foam crash truck. Over one hundred of these trucks are now being built for use in Navy Air Stations here at home and overseas.

Extinguishes gasoline fires in minutes!

These truly all-purpose fire trucks will be available for civilian fire department use in fighting gasoline and other inflammable liquid fires - as well as structural fires. The most advanced equipment and methods used in winning our war against fire will be fighting to save the property in your care.

It's Aqua-Foam

Aqua-Foam contains the essential fire-resistant ingredients for smothering most burning liquids. It has been furnished in large quantities to the Navy Bureau of Aeronautics, as well as to the Army, for fighting crash fires. The foam applicators - Aqua-Foam nozzles - have been installed to improve the performance of Navy high pressure fog trucks, as well as crash fire trucks used by the Bureau of Aeronautics.

Foam nozzles fit Aqua-Gas nozzles. One nozzle kit fights all types of fires.

Through Fire Appliance Company, all the tools you will need to control ANY type of fire in your community will soon be yours, in compact units which will complement - not render obsolete - your existing investment in fire fighting equipment.

Saves property - Costs less!

Yours for better fire control,

Duncan P. Hunt

Aqua-Gas NOZZLES · APPLICATORS · AND SYSTEMS **Aqua-Foam**

. . . *Automatic*

SYSTEM OF FIRE PROTECTION

REGISTERED TRADE MARK

FIRETOX

FIRETOX is listed in your Phone Directory. Consult a FIRETOX SPECIALIST — his services are available on all Fire Protection problems.

Protects valuable property in these typical locations . . . Gas and Diesel generator rooms, transformer vaults, motor, control and switch rooms, relay stations, electrical equipment . . . Boiler, storage, trash, paper rooms, record vaults . . . Attics, basements, garages . . . Public buildings, banks, libraries, schools . . . Storage of flammable liquids, such as gasoline, paint, lacquer, naphtha, alcohol, oils, lacquer solvents, etc. . . . Unheated buildings.

• ***THERE'S NO DAMAGE FROM WATER*** •

How it works.

Carbon tetrachloride is the extinguishing medium, ammonia is the motive power, expelling the carbon "tet" under pressure and effectively preventing the presence of chlorine, hydrogen chloride and phosgene.

FIRETOX is installed on the ceiling and has a standard 165° head, atomizing the carbon "tet" into the air, where it is transformed to a heavy gas vapor — settling like a blanket over the fire! One unit protects 10 x 12 ft. confined area. No Water Damage!

* FM **FIRETOX SYSTEM, INC.**

MAIN OFFICE: 998 FARMINGTON AVE., WEST HARTFORD, CONN.

*The approval identification mark of the Factory Mutual Laboratories appears on the label of each device.

Elevated Tank Provides Gravity Pressure

This 75,000-gal. Horton elevated tank provides gravity water pressure for fire protection at Continental Can Company's Container Division plant at Reading Penna. It is an ellipsoidal-bottom structure with an ellipsoidal roof and is 100 ft. to the bottom. Write our nearest office for quotations or information.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND	CHICAGO	BIRMINGHAM	NEW YORK
WASHINGTON	HAVANA	ATLANTA	PHILADELPHIA
HOUSTON	TULSA	LOS ANGELES	SAN FRANCISCO

like having a

FIRE DEPARTMENT

IN YOUR OWN PLANT

INDUSTRIAL SPRINKLER SYSTEMS

Viking Sprinkler Systems go into action with the speed of a Fire Department in your own plant. In peace and war Viking Sprinkler Systems are protecting industrial plants across the nation against the universal enemy of production . . . . FIRE. There is a Viking dealer near you to give you all the facts.

VIKING CORPORATION DEALERS

Crawford & Slaten Co.
Atlanta, Georgia

C. W. Hutchinson, Inc.
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Indiana Automatic Sprinkler Co.
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THE VIKING CORPORATION
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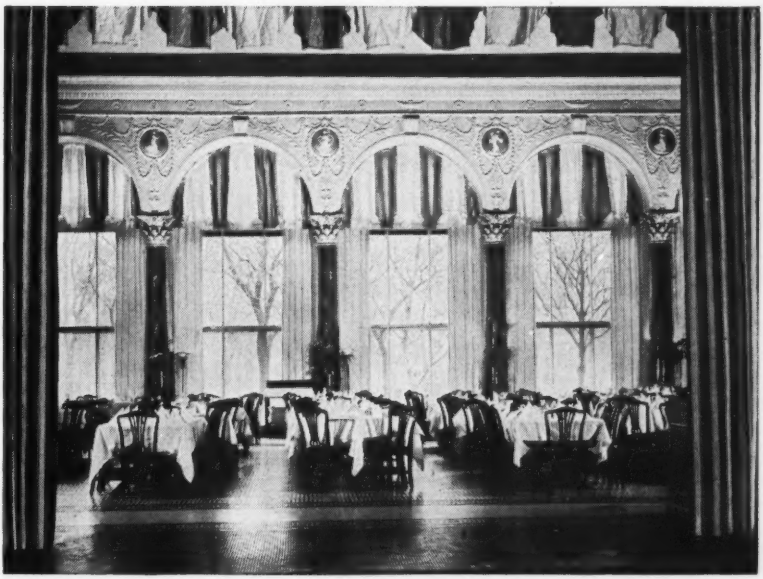


Fire-safe lobby and dining room draperies in the North Shore Country Club, Chicago, Ill. They're FIBERGLAS —Modern Palm Print, grey on lemon, accented by solid color grey and lemon grosgrain. Decorations: Contract Dept., Mandel Bros., Chicago, Ill.

WHAT PRICE A LIFE?

The dreaded cry of "FIRE!" can turn a laughing, happy throng into a frenzied, panic-stricken mob—and lives may be lost that could have been saved. To assure absolute fire-safety, contract designers all over the country are specifying Fiberglas fabrics for places of public gathering. For Fiberglas fabrics CANNOT BURN—woven entirely of finely spun glass filaments, they are not only noncombustible, but won't emit choking fumes when exposed to fire. Never need flameproofing; always operate at 100% efficiency. They look exactly like the handsome, decorative fabrics ordinarily used in smart interiors; but their cost is measured in the lives they can help to save. Now available in a wide range of interesting weaves, solid colors and printed patterns.

WRITE FOR SAMPLES AND INFORMATION

FIBERGLAS*

Fiberglas fabrics are used in all ships of the U. S. Navy (Bureau of Ships Spec. 27 C 7). Listed by Underwriters' Laboratories, Inc., as "Noncombustible Fabric"; approved by Bureau of Standards and Appeals, City of New York.

THORTEL

FIREPROOF FABRICS

Architects Building, 101 Park Ave., New York 17, N. Y.

*T.M. Reg. U.S. Pat. Off. Owens-Corning Fiberglas Corp. ***LExington 2-0711***

Another serious construction fire averted, because FIRE CHIEF Canvas will not flame or support combustion.

This HOOPERWOOD "Engineered Canvas" is equally resistant to water, weather and mildew, greatly lengthening its life in service.

Wherever unprotected canvas presents a fire hazard from hot coals, sparks, hot rivets, welding operations or workmen's torches, carelessly-thrown cigarettes and matches — FIRE CHIEF-Finished Hooperwood Duck assures new safety.

Approved by the Underwriters Laboratories and the Associated Factory Mutual Fire Insurance Companies, FIRE CHIEF also meets all Government requirements for a fire, water, weather and mildew resistant canvas.

Specify FIRE CHIEF for protection.

WM. E. HOOPER & SONS CO.

New York PHILADELPHIA Chicago

Mills: WOODBERRY, BALTIMORE, MD.

• Fire-Chief Finished •

HOOPERWOOD COTTON DUCK

A RECORD THAT'S HARD TO BEAT

It's the reason for the trend to Pyranol transformers

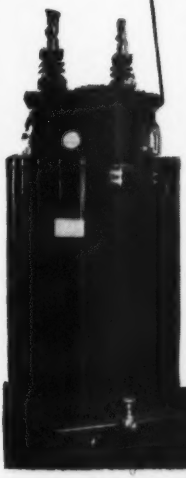
1. OPERATING RECORD 99.8 PER-CENT PERFECT—based on careful records of 12,000 Pyranol* transformers, totaling 2,000,000 kva, installed from 1932 to 1943 in *industrial plants*. In this ten-year period there have been *only* 23 failures.

2. NEVER A FAILURE DUE TO PYRANOL. In *not one* of these 23 failures reported during this ten-year period, did the fact that the cooling liquid was Pyranol have anything to do with the failure. Furthermore, in not one of these 23 cases was anyone harmfully affected physically.

3. NEVER A FIRE WITH PYRANOL. In *no case* has Pyranol burned or contributed to a fire. In *no case* has its vapors formed explosive mixtures with the air. The National Electrical Code permits the use of Pyranol transformers indoors *without* the use of fireproof vaults.

*Reg. U.S. Pat. Off.

No vaults required. You can place the transformer next to the load it is to serve.
Filtering of Pyranol is seldom, if ever, required.
Periodic blowing out of dust is, of course, unnecessary.



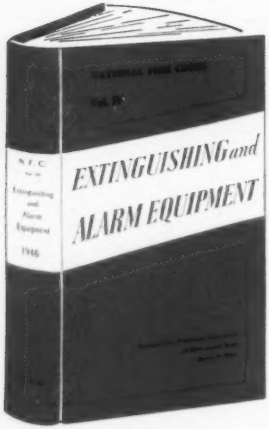
Can you ignore the economic benefits of this time-proved product?

Why should you accept anything short of the greatest reliability, for your power supply? Can you afford unnecessary capital investment in such items as vaults and heavy copper, necessary when oil-filled transformers are used for industrial distribution? Can you afford to have your transformers exposed to dirt, dust, or oil vapors? Can you afford to ignore an operating record such as Pyranol transformers have produced?

For safety, savings, and reliability, specify Pyranol for your next indoor installation of transformers or load-center unit substations. Pyranol units are available for circuits up to 69,000 volts—our new bulletin, GEA-4193, will bring you additional facts. General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

Here It Is - - -



The Revised Edition of

NATIONAL FIRE CODES
Vol. IV

EXTINGUISHING AND ALARM EQUIPMENT
1946

Price $3.00* POSTPAID

This volume of National Fire Codes, now coming off the presses, contains 47 N.F.P.A. standards dealing with automatic sprinklers and water supply, extinguishers and hose, special extinguishing systems, municipal and rural protection, employee organization and related subjects of supervision and maintenance of fire protection facilities. It supersedes and brings up to date the original edition published in 1943.

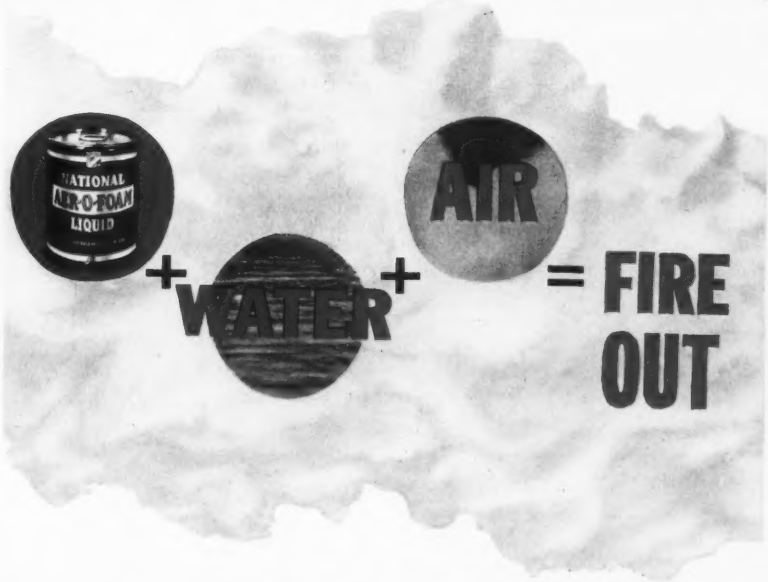
A convenience to readers is the special advertising section included at the end of the book. A new feature, this section provides a ready reference guide to manufacturers of approved fire protection equipment of the various types specified by the standards.

The book contains approximately 700 pages, is completely illustrated and attractively bound in red cloth to match other volumes in the National Fire Codes series. A colorful paper jacket protects the binding.

**Offered to N.F.P.A. members at the pre-publication price of $1.00 per copy. This offer void after Feb. 1, 1946.*

Order Your Copy Today!

NATIONAL FIRE PROTECTION ASSOCIATION
INTERNATIONAL
60 Batterymarch St., Boston 10, Mass.



NATIONAL FOAM, mechanical or chemical, quickly puts out, *and keeps out,* petroleum, marine, chemical, aviation, industrial fires.

NATIONAL FOAM SYSTEM, INC., peace and wartime fire-fighting veteran and the original developer and manufacturer of Aer-o-foam, also supplies chemical foam, tried and proven over a generation in industry throughout the world.

Mechanical (Aer-o-foam) or chemical foam both form thick, tough, enduring blankets smothering flames, insulating threatened areas, blocking flashbacks. National Foam sticks to angular surfaces as well as flowing freely over level areas, quickly sealing off flame-feeding oxygen. National Foam now protects peacetime industry as fully as it guarded our wartime forces.

Foam and fire-preventing and fire-fighting equipment are made by National Foam to fit your requirements. Our engineers, our experience, are yours for the asking. Wire, write or call today.

NATIONAL FOAM SYSTEM, INC.

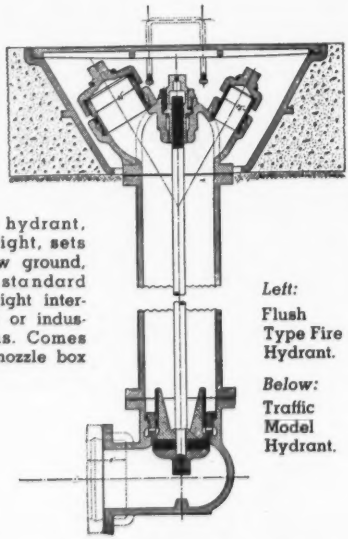
SPECIALIZING IN FOAM FIRE PROTECTION

Packard Building, Philadelphia 2, Pa.

VALVES HYDRANTS

AND PIPE LINE ACCESSORIES

M & H furnishes a complete line of AWWA Valves, iron body, bronze mounted.



Flush type fire hydrant, illustrated at right, sets completely below ground, is used where standard type hydrant might interfere with traffic or industrial operations. Comes with cast iron nozzle box and cover.

Left: Flush Type Fire Hydrant.

Below: Traffic Model Hydrant.

AWWA & UNDERWRITERS APPROVED FIRE HYDRANTS

M & H Fire Hydrants are dry top and revolving head. They are easy to lubricate. Maintenance costs are low due to simplicity of design and rugged construction. They have low friction loss and great efficiency because barrel diameter is not reduced and there are no working parts or obstruction in waterway. Special Traffic model is designed to yield at the ground line under impact. Repair is simple and easy.

M&H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

Modern Seaboard Diesel Engines... Protected by Modern C-O-Two

Modern fire protection on high speed diesel locomotives is not only imperative, it's good business. Past experience has shown that should a fire occur in a diesel locomotive, travelling at high speed — it can cause serious damage and high loss to equipment. Due to the high speed, wind conditions are greatly increased, thus the fire spreads quickly, destroying valuable equipment. Adequate protection—quick detection and fast extinguishment of diesel engine fires is a must.

Smoke Detecting Unit

C-O-TWO engineers solved this problem to the satisfaction of the Seaboard Railway. Fires over the engines are detected by a fire alarm system operated by thermostatic control. To quickly extinguish fires in these areas two tanks of fast acting, non-damaging, non-conducting carbon dioxide are provided along with two carbon dioxide hose reel systems. Fires in parts of the engine-trucks, over fuel tanks and battery boxes are detected by the ever-alert C-O-TWO Smoke Detector. For these hazards, C-O-TWO equipment provides pressure for foam and water type extinguishers supplied by our affiliate, Pyrene Manufacturing Company.

Modern fire protection for diesel engines—whether for transportation or stationary jobs is another C-O-TWO development. Write today for full information.

C-O-Two
Fire Equipment Company
NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

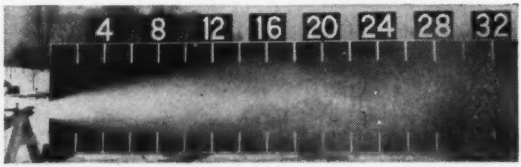
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

THE REAL STORY OF FMC

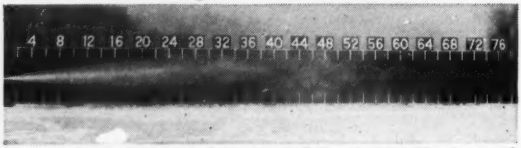
Don't confuse the results obtainable from FMC High-Pressure Fog Fire Fighting with any other system. There's nothing else like it for efficiency, for speed, for all-type fire protection.

These unretouched photographs show various applications of high-pressure fog as it is actually discharged from a standard FMC Fog Fire Gun. Several of the many settings are shown proving the true carrying power and steam-like fog that is usable for the speedy, efficient quenching of various types of fires. The standard capacity of one gun (two guns per unit) is 30 gallons per minute at 600 lbs. gun pressure.

All of our claims for the effectiveness of high pressure refer only to the FMC System.



WIDE FOG CLOUD. Not a hollow cone spray, but a fine dense fog with a harmless amount of entrained air at the blaze. Has an effective range of 20 to 24 feet. Imagine fighting a fire with this closely-packed fog! The fire couldn't help but cool down and smother out, and without water damage.



MIDDLE SETTING. Combination of distance, wide fog and density. Not a hollow cone! Has long range effectiveness of 30 to 40 feet. No harmful entrained air at the blaze. Very effective—reaches fire without endangering firemen. One man can handle easily. Fires can be put out without usual water damage.

LONG RANGE STREAM. Necessary only for great distance. Has reach of 50 to 60 feet. Has tremendous carrying power, penetration and effectiveness. Still is fire-fighting fog—making every gallon do maximum work. Used to reach "hard-to-get-at" fires. Uses much less water. No harmful entrained air at the blaze. One man handles gun and hose in moving around at fire.

BUILDERS OF BEAN HIGH-PRESSURE

HIGH-PRESSURE FOG FIRE FIGHTING

The Modern Way of Fighting Fire. The FMC High-Pressure Fog Fire Fighting System—originated by the John Bean Mfg. Co.—has revolutionized fire-fighting technique. *It's the Pressure that Counts!* In fighting fire with fog—you must have high pressure. And that's what you get with the FMC Fog Fire Fighter.

The FMC High-Pressure Pump packs the needed punch to produce and maintain *800 lbs. pump pressure*—better than *600 lbs. nozzle pressure.*

A Little Water Goes a Long Way! The high pressure gives you a combination of high velocity and finely-atomized water—just what you need to *blast—cool* and *smother* flame.

One gallon of this finely-atomized fog—properly used—has the fire-quenching possibilities of many times that of low-pressure water. Get the facts! FMC High-Pressure Fog is one of the greatest contributions ever made to fire fighting. Write today — for complete information.

★ ★ ★

STANDARD FMC FOG FIRE FIGHTER. A self-contained fire fighting unit. Carries its own water supply and complete fire-fighting equipment. Provides two guns of 30 gallons each at 600 lbs. nozzle pressure.

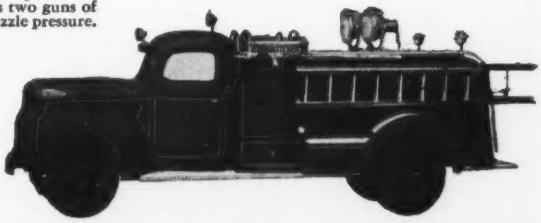
FMC FOG FIRE GUN

Built Only by Bean

The FMC Fog Fire Gun is designed especially for high-pressure work.

Note these Features:

1. **PROTECTIVE SPRAY.** Special spray protects face and shoulders from heat.
2. **ADJUSTING BARREL.** By turning barrel, flow can be changed from a straight "power" stream to a close-up fog for any type of fire.
3. **TRIGGER GRIP.** Gives natural position to arm and grip and is easy to hold.
4. **GUN LOCK.** Stream can be set in any pattern and locked there if desired.
5. **HOSE SWIVEL.** Eliminates bothersome twisting of hose.



FMC *Original* HIGH-PRESSURE FOG FIRE FIGHTER

CAN BE MOUNTED ON MOST STANDARD TRUCK CHASSIS

FOOD MACHINERY CORPORATION

John Bean Mfg. Co., 739 Hazel St., Lansing 4, Mich. • Bean-Cutler Division, 439 Julian St., San Jose, Calif.

PUMPS FOR OVER SIXTY YEARS

A CENTRAL SPRINKLER SYSTEM

FOR EVERY FIRE PROTECTION SERVICE

SIMPLE IN CONSTRUCTION

DEPENDABLE IN OPERATION

CENTRAL Standard Wet and Dry Pipe Systems

CENTRAL Thermostatically Operated Rate-of-Rise Open and Closed Head Deluge Systems

CENTRAL Fog Nozzle Manual and Automatic Systems

Self Liquidating as to Cost Through Reductions in Insurance Premiums

CENTRAL AUTOMATIC SPRINKLER CO.

Home Office and Factory: Cannon Avenue at Fourth Street

LANSDALE, PA.

Offices and Licensees in Principal Cities of United States and Canada

S-O-S Fire Guard

vaporizing liquid extinguisher (above) is Underwriters' approved for use on electrical, chemical, gasoline, and paint fires. One quart or 1½ qt. size.

WOULD you use a bus for bricks? A panel truck for gravel? Not likely. Every vehicle has its own job.

And every fire extinguisher also has its own job. Gasoline and oil fires, for example, call for an entirely different extinguisher than textile and rubbish fires.

Stationed near you is a trained Fire Protectioneer able to advise you on the correct equipment for your every fire hazard. Backing him is this 40-year-old concern, manufacturing a *complete line* of Underwriters' approved fire extinguishers. There is no charge for this service.

Call your distributor or write direct.

IF IT'S GENERAL IT'S DEPENDABLE

THE GENERAL DETROIT CORP.

2270 E. JEFFERSON AVE., DETROIT 7, MICH.

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GLOBE

AUTOMATIC SPRINKLERS

EMBODY UNIQUE FEATURES OF ADVANCE DESIGN

Globe SAVEALL Chemical Sprinkler
Globe SAVEALL Dry Pendent Sprinkler
Globe SAVEALL Sidewall Sprinkler
Globe Dry Pipe Valve Model "A-D"
Globe Air Maintenance and Quick Opening Device
Globe SAVEALL Master Control Valve
Globe SAVEALL Airomatic System — Wet and Dry

All current models — the product of continuous research, vigorous development and long experience — more responsive, flexible and enduring, provide long life and minimum maintenance and are approved by all Government and Insurance Authorities.

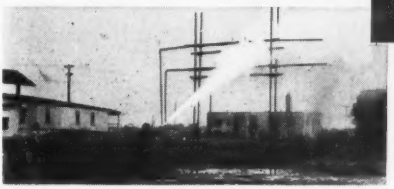
OUR GOAL
With added speed and certainty, to
AUTOMATICALLY
discover, alarm, and extinguish fires.

GLOBE
Automatic Sprinkler Co.
2035 WASHINGTON AVENUE
Philadelphia 46, Pa.
SALES OFFICES IN PRINCIPAL CITIES

THIS TOUGH GASOLINE FIRE KILLED IN 65 SECONDS

9:15 A.M. . . . Gasoline escaping at rate of 10 gallons per minute under 50-lb. pressure through three hacksaw cuts in pipe 13 ft. above ground is "touched off."

9:16 A.M. . . . After being allowed to burn furiously for a full minute, the *straight stream* of the new Dual-Stream Nozzle of a No. 350-A Wheeled Extinguisher is directed at blaze.



9:17:05 A.M. . . . In just 65 seconds, this tough overhead gasoline fire (including blaze on ground) is OUT.

NEW DUAL-STREAM NOZZLE . . .

deals effectively with spill fires difficult to reach because of height or obstructions. Designed for use with DUGAS Wheeled Extinguishers, the new Dual-Stream Nozzle greatly increases fire-fighting range and effectiveness. A turn of the handle gives a *straight* stream with a range of 45 ft.—or a *fan* stream with a range of 15 ft.

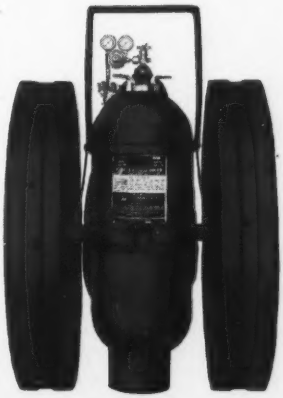
Write today for complete information regarding DUGAS Wheeled Extinguishers with the New Dual-Stream Nozzle . . . and DUGAS Hand Extinguishers.

Quick Facts About DUGAS Dry Chemical

- For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
- Not an electrical conductor.
- Non-toxic, non-corrosive, non-abrasive.
- Not affected by extreme cold or heat.

AN ANSUL PRODUCT — dugas — THE MASTER OF FLAME

Approved by Underwriters Laboratories, and Factory Mutual Laboratories.



DUGAS 350-A WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

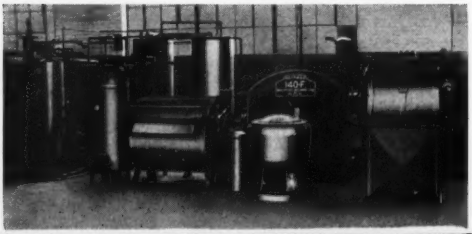
LOOK AT THE RECORD MADE BY HOFFMAN

140-F SAFETY DRY CLEANING

It's a record to be proud of—the clear loss record made by the Hoffman 140-F drycleaning system, in hundreds of installations during the past six years! The point is—this is Petroleum Solvent Equipment—not a chlorinated solvent unit! It's the original Safety Petroleum Solvent Unit—an exclusive U. S. Hoffman development to promote greater safety in the drycleaning industry. An approved Class III system, the 140-F complies with standards of National Board of Fire Underwriters Pamphlet No. 32. Most inspection departments permit installation without enclosing walls.

USES 140° FLASH PETROLEUM SOLVENT

The Hoffman 140-F drycleaning system employs safety solvent with flash-point of approximately 140° F. The system is offered to the drycleaning industry in 12 different types—each one tested and listed by the Underwriters' Laboratories Re-examination Service.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING, LAUNDRY & GARMENT PRESSING EQUIPMENT

– but it meant a $450,000 FIRE LOSS!

Put yourself in the place of the owners of this plant. Three of your buildings completely destroyed, with a fire loss of $450,000—all because your *fire protection did not protect.*

Not a pleasant situation—

But there is another side to the fire-protection picture. We call it the "Automatic" Sprinkler side. Long years ago "Automatic" Sprinkler established a course of action from which it has never deviated—*to produce fire protection systems and devices that answer the need for complete and adequate protection, no matter what the fire hazard.*

This policy has paid handsome dividends to users of "Automatic" Sprinkler equipment. It will continue to do so. For singleness of purpose, coupled with intelligent and persistent research, has resulted in *fire protection that really protects.*

"Automatic" engineers are well qualified to help solve your fire hazard problems. Write us today.

A famous member of the "Automatic" Sprinkler Family. Provides adequate protection from quench tank, transformer, oil line and other fires of flammable liquid origin.

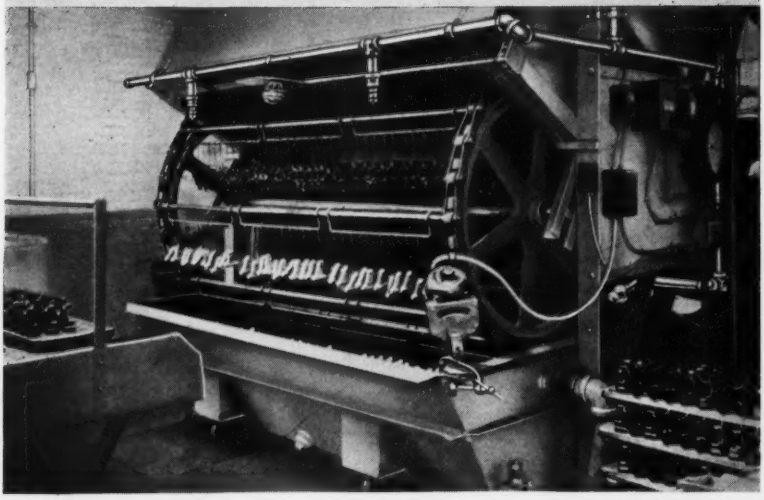
"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

WaterFOG STEPPED ON THE FLAMING GAS



. . . before the heat reached the sprinkler heads

A flashing arc ignited volatile gases inside this enamel-drying oven. The WaterFOG system inside the oven was immediately opened by the automatic fire detection device, releasing clouds of WaterFOG which blanketed the oven . . . rapidly absorbing heat from the flames and shutting off oxygen. So quickly was the fire under control that not enough heat reached the top of the room to actuate the sprinkler heads only eight feet directly above the tank!

Donald B. Swain, General Superintendent of the Millers Falls Company, Greenfield, Mass., writes: "We cannot see how it would be possible for any form of fire protection to function more perfectly."

Rockwood WaterFOG Offers Your Surest Protection

WaterFOG . . . water broken up into particles much finer than spray . . . attacks flammable liquid fires three ways. Soaks up heat necessary to sustain combustion. Retards vaporization. Closes off oxygen supply. WaterFOG's gentle action avoids splashing, the oil . . . flash-back is prevented because the surrounding structure is cooled.

Used by industrial plants, refineries, utilities, Rockwood-engineered fixed installations are approved by Underwriters' Laboratories, Inc. and Associated Factory Mutuals . . . nozzles and applicators for fire hose lines by Underwriters' Laboratories, Inc.

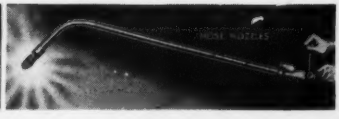
ROCKWOOD SPRINKLER COMPANY

56 Harlow Street, Worcester 5, Mass.

Specialists in Fire Protection Engineering, Equipment and Installation since 1907

Water Engineered by Rockwood Cools, Confines, Smothers Class "A" and Oil Fires

ROCKWOOD WaterFOG



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Delayed Alarms

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Fire Losses

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PROTECTOSPRAY

Grinnell ProtectoSpray Systems give control of fires in highly volatile liquids and provide protection through cooling for pressure vessels, piping, equipment and structures in fire hazard areas. This medium-velocity, fine spray protection prevents the heat of the fire from causing serious damage by maintaining a coating film of water on the protected surfaces.

ProtectoSpray equipment is particularly applicable to areas which may be exposed to fires in vapors from flammable liquids. Where the cooling spray can be applied to the whole of a fire zone, extinguishment may occur, but the primary function of ProtectoSpray is insulation and cooling.

ProtectoSpray installations are of the dry type, eliminating the dangers of freezing. Water is released into them by automatic control. Automatic control may be for either fixed temperature or rate-of-rise operation, using controls thoroughly tested and proven in many years of use in other types of Grinnell Fire Protection equipment.

Further information on ProtectoSpray and other Grinnell Fire Protection systems is available from Grinnell Company, 260 West Exchange Street, Providence 1, R. I., or Branch Offices in principal cities.

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